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Special Punching Machine—Double Angle Shears.

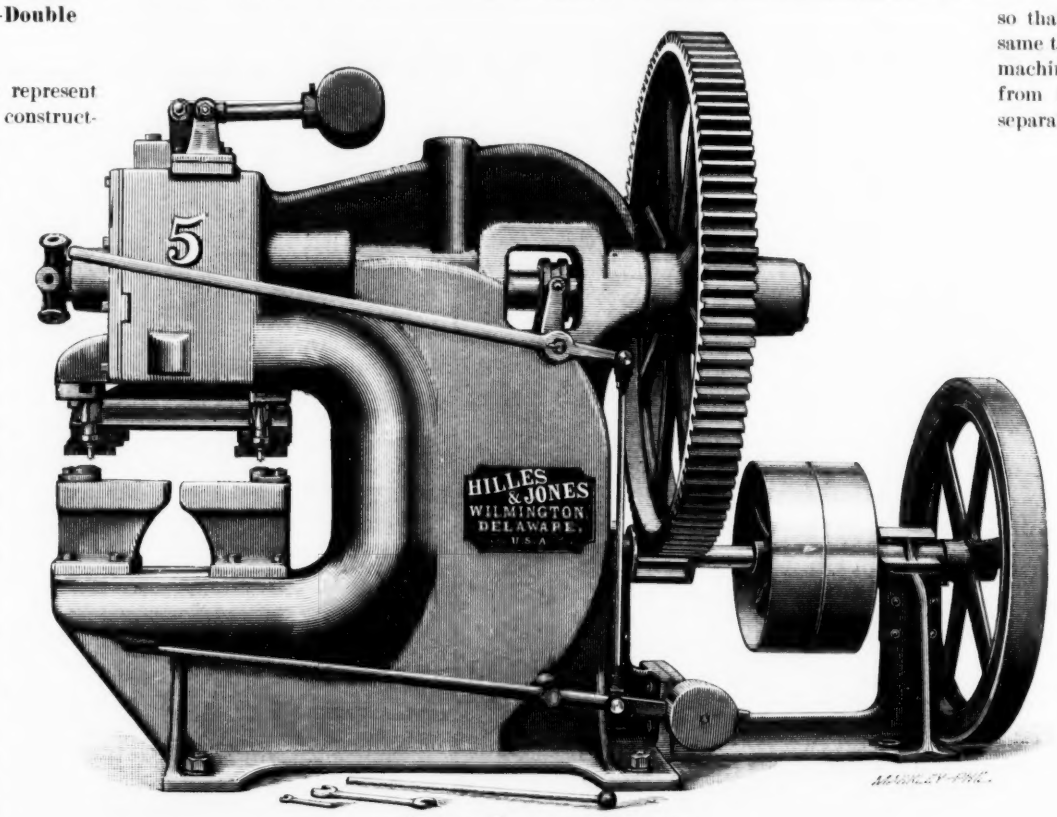
The illustrations on this page represent some improved machinery recently constructed by Hilles & Jones, of Wilmington, Del., intended specially for iron or steel, ship and bridge builders' use.

The first machine is a special punching machine, in which the punches are adjustable so that holes may be punched at any distance apart from 3″ to 24″, center to center. It is so constructed that channels and I beams can be punched on the flanges or the web. Since in work of this kind there are generally many "staggering" or irregularly spaced holes, there is provided not only a clutch for starting and stopping the punches, but also a "gag" on each punch, so that they can be worked entirely independently of each other when desired. In fact, the "gag" is generally used in stopping, in preference to the clutch.

The machine has sufficient power and strength to punch two $1\frac{1}{16}$″ holes through 1″ iron, when the punches are at the extreme distance apart (24″), so that other punches may be attached and brought into use on lighter work.

When so desired, the machine can be furnished with a shearing attachment for cutting out the flanges on angles, channels and I beams. Though ordinarily built as the illustration shows it, when so ordered it is furnished with an engine attached to the frame. The weight of the machine as shown is about 24,000 lbs.

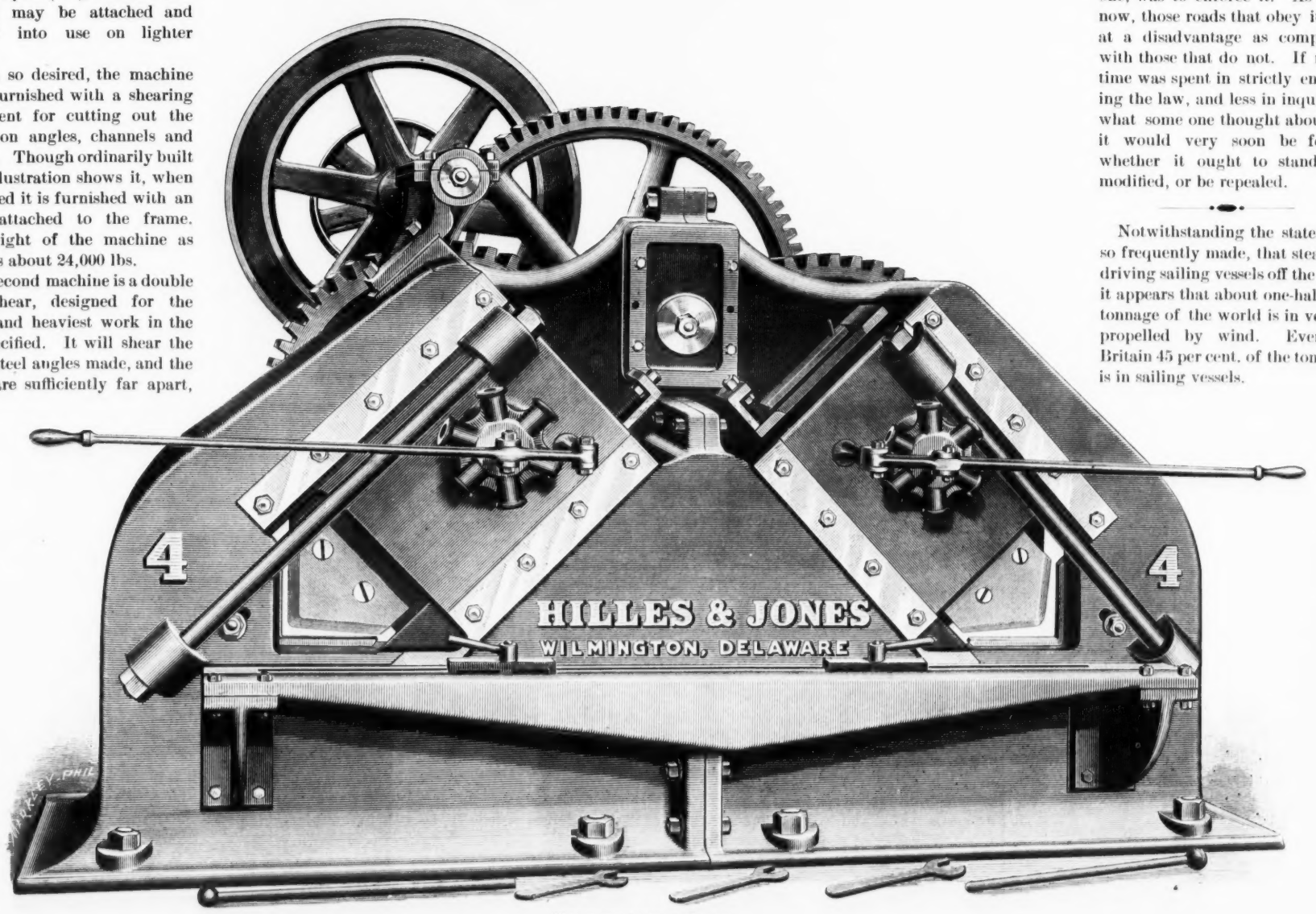
The second machine is a double angle shear, designed for the largest and heaviest work in the lines specified. It will shear the largest steel angles made, and the knives are sufficiently far apart, so that two gangs of men can work at the same time, particularly so as each side of the machine is entirely independent and separate from the other, each being worked by a separate clutch thrown in by the levers shown in front.



SPECIAL PUNCHING MACHINE.

Angles can be cut square off, or "right and left," so as to form a miter, as frequently has to be done in bridge work. Clean cuts are made, and the part cut off retains its shape, thus saving the work sometimes done in the blacksmith shop in squaring up the ends of angles.

This machine, like the other, is furnished, when desired, with an engine attached to the frame, so that shafting and belts are dispensed with, and the machine can be placed in any position in the shop or yard where a steam pipe can be attached to it. The approximate weight is 36,000 pounds.



DOUBLE ANGLE SHEAR.

Charles Francis Adams, president of the Union Pacific Railroad, was quite right when he told the Inter-State Commerce Commission that the proper way to find out whether the Inter-State Commerce law was a good one, was to enforce it. As it is now, those roads that obey it are at a disadvantage as compared with those that do not. If more time was spent in strictly enforcing the law, and less in inquiring what some one thought about it, it would very soon be found whether it ought to stand, be modified, or be repealed.

Notwithstanding the statement so frequently made, that steam is driving sailing vessels off the seas, it appears that about one-half the tonnage of the world is in vessels propelled by wind. Even in Britain 45 per cent. of the tonnage is in sailing vessels.

Improved Drill Press.

On this and the following page we illustrate a new line of drill presses brought out by Lodge, Davis & Co., Cincinnati, Ohio, which embody several improvements not found in the drill presses heretofore built by them. The most prominent of these is the device for automatically disengaging the feed, which we illustrate in detail.

On the front of the spindle sleeve is a line of graduations, and at the side, fitted to a dove-tailed slot, is a pointer *b*, which, by a knurled nut, can be clamped at any desired position on the slot. Through an extension of this pointer passes the screw shown, the end of which comes into contact with the lever *d*, the other end of which engages with a ratchet wheel *f*, which is keyed to a shaft passing through the worm shaft, and having at the other end the usual knurled button for manipulating the feed. This shaft is threaded through the friction disk, and when the feed is in operation all these parts, of course, revolve together in the usual manner, the end of the lever *d* not coming in contact with the ratchet wheel.

When the drill spindle descends to the predetermined point, the lever is brought into contact with the ratchet wheel, and its motion arrested, thereby loosening the friction in the same manner as would be done by hand, by means of the button at the hand-wheel. Any number of holes may thus be drilled to the same depth, without the necessity for measuring or the possibility of drilling too deep.

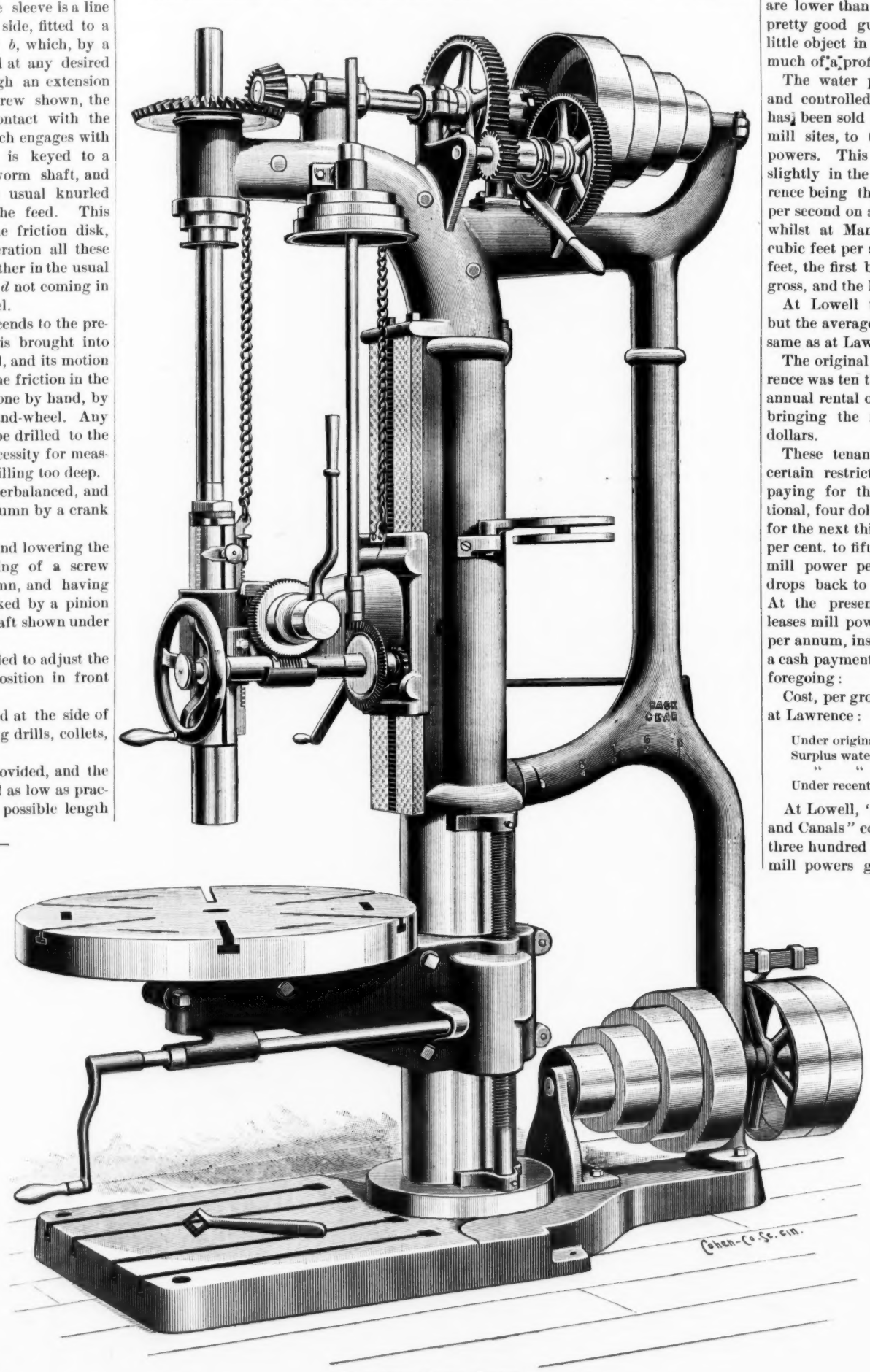
The sliding head is counterbalanced, and is moved up or down the column by a crank and rack and pinion.

A new method of raising and lowering the table is introduced, consisting of a screw fixed at the side of the column, and having fitted to it a bevel gear worked by a pinion which is on the end of the shaft shown under the table.

The operator is thus enabled to adjust the table without leaving his position in front of the machine.

A swinging rack is provided at the side of the column, fitted for holding drills, collets, sockets, etc.

The usual back brace is provided, and the lower cone pulley is placed as low as practicable to secure the greatest possible length of belt.



Improved Drill Press.

An Evidence of Enterprise.

(From the *United States Economist and Dry Goods Reporter* of May 4.)

Mr. Max Jaegerhuber, of the staff of this paper, sails this morning with his family for Europe on the steamer "Veendam." Mr. Jaegerhuber makes this trip in the interests of the *Economist*, and is especially commissioned to investigate for the paper the subject of European textile technical education. The results of this investigation will be given for the benefit of the textile school movement in this country, which the paper is laboring to promote. Mr. Jaegerhuber's correspondence on textile matters will be an interesting feature of the *Economist* this summer. Moreover, he will arrange for putting this journal in correspondence with the fountain heads of information abroad relating to foreign goods and raw materials—a feature which will be valuable and interesting to our whole constituency.

The Government is to continue, this year, its experiments in growing sorghum and making sugar.

It is said Philadelphia has 172 carpet factories, employing 17,800 hands.

Comparative Cost of Steam and Water Power.

By Charles H. Manning, Manchester, N. H.

A paper presented at the Erie meeting of Mechanical Engineers.

The circumstances under which steam and water powers; so that, if we can show that steam can compete successfully with water here, it surely can elsewhere in the same lines of production.

The history of the development of the cotton and wool industries of this country includes with it the development of the great water powers; for when these industries commenced to assume large proportions, the stationary steam engine was in its infancy, water come into competition as motive powers vary so widely with geographical situation, purpose to which the power is to be put, and other conditions too numerous to be mentioned in a short paper, that I shall confine myself pretty closely to the condition of things in cotton and woolen manufacturing along the valley of the Merrimack River.

Along this stream are situated Lawrence, Lowell and Manchester, three of the leading textile manufacturing cities of New England, and cities, too, which were created by their water powers, and are to-day dependent upon them for their existence. Their growth has been phenomenal, and is a striking illustration of the value of water power. Lowell, in 1820, had a population of 200; in 1830, 6,474; in 1840, 20,796; in 1850, 33,383; in 1860, 36,827; in 1870, 40,928; in 1880, 59,475; and in 1888, 77,696. Lawrence, in 1845, had a population of 8,283; in 1850, 17,639; in 1860, 25,275; in 1870, 28,921; in 1880, 39,151; and in 1888, 44,654. Manchester, in 1838, had a population of 1,500; in 1840, 2,500; in 1850, 13,932; in 1860, 20,107; in 1870, 23,536; in 1880, 32,630; and in 1888, 56,987. Lowell, Lawrence and Manchester, in 1888, had a population of 179,337, or about one-fifth of the population of the State of New Hampshire.

The water power at Lowell is owned by the Proprietors of the Locks and Canals, and has been sold in mill powers, together with mill sites, to the extent of about 130 mill powers. This unit of water power varies slightly in the different places, that in Lawrence being thirty (30) cubic feet of water per second on a fall of twenty-five (25) feet, whilst at Manchester it is thirty-eight (38) cubic feet per second on a fall of twenty (20) feet, the first being equivalent to 85.23 H. P. gross, and the latter to 86.36 H. P. gross.

At Lowell there are three different falls, but the average mill power there is about the same as at Lawrence.

The original cost of a mill power at Lawrence was ten thousand dollars, subject to an annual rental of three hundred dollars more, bringing the real cost to fifteen thousand dollars.

These tenants have also the right, under certain restrictions, to draw surplus water, paying for the first twenty per cent. additional, four dollars per day per mill power; for the next thirty per cent., or from twenty per cent. to fifty per cent., eight dollars per mill power per day; above fifty per cent. it drops back to four dollars per day again. At the present time the Essex Company leases mill powers at twelve hundred dollars per annum, instead of the former method of a cash payment and rent. To summarize the foregoing:

Cost, per gross H. P. per annum, of water at Lawrence:

Under original leases	$10.55
Surplus water up to 20%	14.51
" " from 20% up to 50%	29.02
Under recent leases	14.08

At Lowell, "The Proprietors of The Locks and Canals" continue to charge themselves three hundred dollars per annum rent on all mill powers granted in the original leases, and charge five dollars per day per mill power for surplus water up to forty per cent.; exceeding forty and up to fifty per cent., ten dollars per day; from fifty to sixty per cent., twenty dollars per day; and when any one exceeds sixty per cent., they must pay twenty dollars per day per mill power for the entire surplus.

On the original leases cash payments of ten thousand dollars per mill power were made, so that on original leases the cost per gross H. P. is the same as at Lawrence, or, summarizing as before:

Cost, per gross H. P. per annum, of water at Lowell:

Under original leases	$10.55
Surplus water up to 40%	18.14
" " from 40 to 50%	36.28
Surplus water from 50 to 60%	72.56

At this latter price water becomes an expensive luxury.

The original leases amount to about one hundred and forty mill powers, or nearly twelve thousand gross H. P., which at the present time is supplemented by about eighteen thousand H. P. of steam.

At Manchester the water power is owned by the Amoskeag Manufacturing Company, who made original grants at about the same terms as Lowell and Lawrence, except that, as the mill power is a trifle greater, it makes low figures, the companies making their profits by the sale of lands rather than by the water power.

The system at Lowell differing somewhat from the other two, in that the water power is owned and controlled by a stock company made up of the manufacturing companies themselves in proportion to their water rights, therefore, as they buy from themselves, their prices, which, as a general thing, are lower than Lawrence, may be taken as a pretty good guide as to the cost, as there is little object in their making themselves pay much of a profit.

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the cost per gross H. P. a few cents less. For some years tenants were allowed to use surplus water without charge, but when the capacity of the power at low stages of the river was reached, a charge of five dollars per mill power for surplus water was made. This was the means of causing several of the mills to substitute auxiliary steam power for surplus water; but still later, the Amoskeag Company having reduced the charge to two dollars per day per mill power, tenants who are equipped to do so use surplus water whenever allowed.

We will summarize now for Manchester.

Cost per gross H. P. per annum at Manchester:

Under original leases	$10.42
Surplus water	7.15

It is usual in computing water powers to subtract one foot from the head as measured from still water, which is an allowance for loss of head in the water entering and leaving the wheel.

The efficiency of a first-class turbine should be about eighty-five per cent. of the net fall, so that, if we consider that the average wheel that would be put in to-day will deliver to the shaft seventy-five per cent. of the gross power paid for, we shall not be far wrong.

Under these circumstances the net H. P. would cost $\frac{10.50}{.75} = 14.00$ for water under the original leases.

The cost of the plant will vary largely per H. P. inversely with the head under which it is used, as the greater the head the smaller the wheel for a given amount of power; but under a head of about thirty feet, the cost of a modern plant of about 1,000 H. P. would be as follows:

Feeder head-gates, rack, etc.	$ 3.70	per N. H. P.
Steel pen-stocks	14.60	"
Wheel-pits, piers, etc.	11.20	"
Wheels, casings, draft-tubes, and shafting	22.00	"
Total cost of plant	$51.50	"

To be able to maintain speed during freshet times, an extra allowance of wheel power is made, except where the wheels are placed between two canals, and this varies from twenty-five to fifty per cent., so as an average we will allow thirty-three and a third per cent., bringing this cost to $51.50 \times 1.33\frac{1}{3} = 68.67$. To this must be added, for a sinking fund for renewals, four per cent.; repairs, one and a half per cent.; proportion of general expenses, such as insurance, taxes, interest, etc., six per cent.

Summing these up:

Sinking fund	$2.75
Repairs	1.03
General expenses	4.12
Total	$7.90

Wages of a wheelman, at $2.00 per day for three hundred and nine days a year, would be $618, and supplies, such as packing, oil, and waste, $100 per annum, or about .72 per H. P. per annum.

Total cost per N. H. P. per annum under original grants:

Cost of water	$14.00
Sinking fund, etc	7.90
Attendance and supplies	.72
	$22.62

If the water is supplied from surplus at four dollars per mill power per day, this must be increased by $\frac{4 \times 309}{65} - 14 = 5.01$, making the cost $27.63; and by a similar computation, if the water is "surplus" at $2.00, the cost decreases to $16.20.

We now come to the consideration of the steam side of the question, which is a more complex matter, as the cost of steam power varies greatly with the uses to which a portion or the whole of the exhaust steam may be applied.

In a cotton mill where only white cloth is produced, there is very little use for exhaust or back-pressure steam, except for slashing the year around, and heating for from five to seven months; and undoubtedly the compound engine, using steam of one hundred and fifty lbs. pressure or over, and cylinders so proportioned as to allow a portion of the steam from the intermediate receiver to be used for heating, etc., is the best type.

In woolen mills, and cotton mills producing colored goods, there are large demands the year around for low-pressure steam for dyeing and drying purposes, and where such a mill is driven entirely by steam there will in winter time be use for at least three-quarters of all the exhaust steam in the various processes.

If one-half of the mill is driven by water power, the engine to drive the remainder should be a simple engine, running always against a back pressure, in which case the power will be obtained at a very small cost.

We will consider only these two extreme cases, and in both we will consider 1,000 N. H. P.

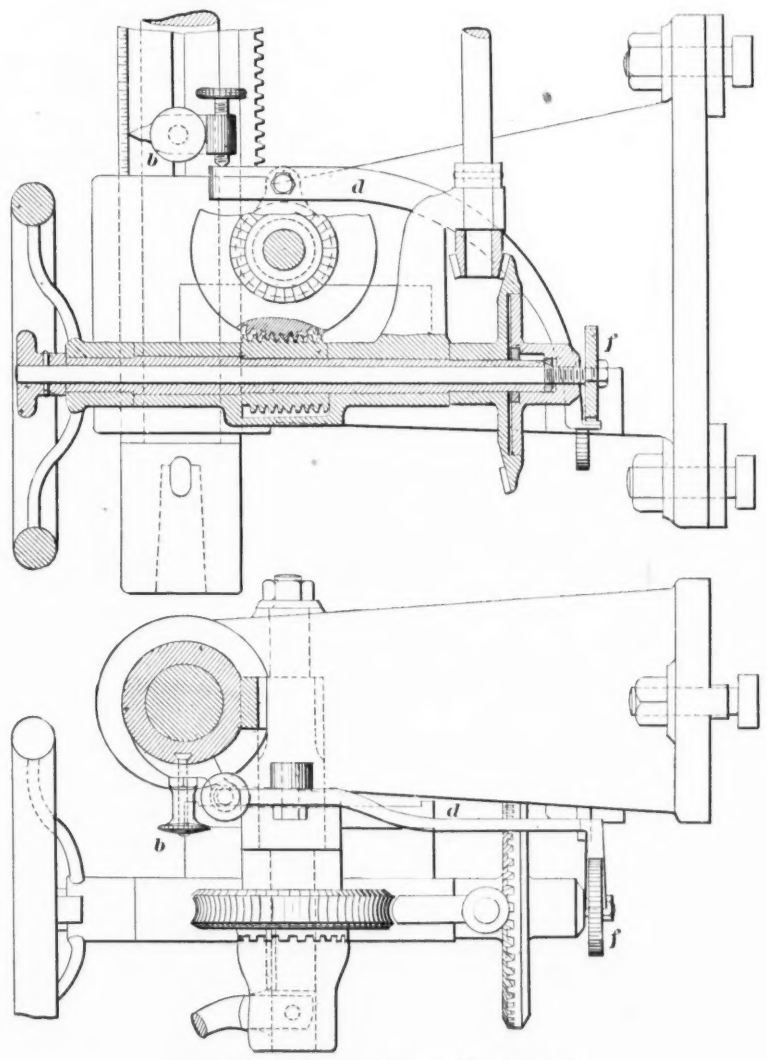
A well-designed compound engine should, when using high steam, say of 150 lbs. gauge pressure, deliver to the shafting 93 per cent. of the H. P.; therefore, to deliver 1,000 N. H. P. the engine should indicate $\frac{1,000}{.93}$ = 1,075; but, to be liberal, we will make the calculation for 1,100 H. P. The engine is to run ten hours a day on speed, and, allowing for stopping and starting, this will amount to ten and one-quarter hours per day for three hundred and nine days a year. An engine of this type should be run on one and three-quarter pounds of coal per H. P., including all coal used for starting and banking, and we will take the average cost of such coal at $4.50 per long ton. This brings the cost per H. P. per annum for coal to $12.25, allowing no credit for exhaust steam used in heating, etc.

If the average use of steam from the receiver throughout the year is one-fourth of the whole, the engine should be charged with about one-tenth of the heat supplied by the fuel to this one-fourth; in other words, we must credit the engine with nine-tenths of one-fourth of cost of coal, which reduces the cost of coal to $9.49.

Engineer at $3.00, oiler at $1.50, two firemen at $1.50 each, and one coal-passer at $1.20, will make an annual pay-roll of $2,688.30, or $2.44 per H. P. per annum. Engine-room supplies, $250 per annum, or .23 per H. P. per annum.

Summing up, we have:

Net coal chargeable to engine	$ 9.49	per H. P.
Attendance	2.44	"
Supplies	.23	"
Total running expenses	$12.16	"
COST OF PLANT.		
Engine, including piping and foundation	$27.00	per H. P.
Engine-house	5.00	"
Boilers ready for use	10.00	"
Feed-pumps, injectors, etc.	1.50	"
Boiler-house, chimney, and flues	6.00	"
Coal-shed, tracks, etc.	3.00	"
Total	$52.50	
AS IN THE WATER PLANT.		
Sinking fund at 5%		$2.62
Repairs 2½%		1.31
General expenses, insurance, taxes, interest, etc., 6%		3.15
Total		$7.08
COST PER H. P. PER ANNUM.		
Running expenses		$12.16
Charges on plant		7.08
Total		$19.24



IMPROVED DRILL PRESS.—SEE PAGE 2.

The cost per net horse power per annum will be eleven-tenths of this, or $21.16, which may justly be reduced by the proportion of fire-room expenses and boiler charges equivalent to the portion of the steam used for heating and slashing.

The other case which we will consider is where all the exhaust steam is used at a pressure of about ten pounds above the atmosphere, for other than power purposes. Under these circumstances the engine becomes the simple non-condensing engine corresponding to the high-pressure cylinder of the compound engine; or for very large powers the compound engine may be used, the low-pressure cylinder then being under much the same conditions as the intermediate of a triple-expansion.

In such an engine, single cylinder, the cost of coal per H. P. is three pounds per hour, charging all the coal to the engine; but this can be reduced to two and a half; but we will take the larger amount.

If the efficiency of the boiler plant is 80 per cent., and the engine works between the limits of 150 lbs. per gauge initial pressure, and 10 lbs. per gauge back pressure, it will convert about one-tenth of the total heat required from the fuel by the steam into useful work, or .3 of a pound of coal per H. P., which may be increased to .5 by the condensation in cylinder.

The boiler plant for such an engine will cost more than for the first engine considered, as there is a greater weight of water to be evaporated; but this is fully offset by the decreased cost of engine, especially if the single-cylinder type is chosen. The running expenses and charges on plant will be practically the same as in the former case, but a much larger deduction from fire-room expenses and boiler charges can justly be made from the cost of power.

Our cost of fuel chargeable to power is reduced in this case to $3.50 per H. P. per annum, and, other charges remaining the same, brings the total cost per H. P. per annum down to $13.25, and per net H. P. to $14.58.

At the Amoskeag Mills there is a pair of Corliss engines fitted to run this way, with an initial steam pressure of 100 pounds per gauge running against 10 pounds back pressure, and these engines can be started at any time, and run at 1,200 H. P. without its being felt in the boiler-house, by merely turning the steam for the dye-houses through the engine.

The cost in coal is so small that it falls within the daily variation from other causes, as frequently the consumption will decrease instead of increase when these engines are started.

To sum up, we have the cost per net horse-power per annum:

Water power under original leases	$22.62
Surplus water at $5 per M. P. per diem	27.63
Surplus water at $2 per M. P. per diem	16.20
Compound engine, one-quarter exhaust, used for heater, etc	21.16
Single cylinder, all exhaust used	14.58

As the governing conditions vary in different localities, these computations must be changed accordingly; but when the increased facility of the steam engine for close regulation of speed is weighed on the one hand, and the liability of water powers to flood, drought and ice, I think most will decide in favor of the steam power.

Shop Notes.

The shops of the Stiles & Parker Press Co., at Middletown, Conn., have been built since the fire which took place there about a year ago, and, though not large, are well adapted to their purpose, and well equipped, much of the machinery having been put in new since the fire. The main building is L-shaped, the heavier tools being in one wing, which is provided with an overhead trolley, by which the heavier pieces of work and machines are moved from place to place. They find the demands of their business to be constantly for heavier and larger machinery, having a greater capacity and range of work, and, at the time of our visit, had upon the floor, just completed and undergoing the final tests and adjusting operations, what is believed to be the largest drawing press ever constructed. It is built upon a plan similar to the press which we illustrated in our issue of June 30, 1888, but instead of two toggle joints to move the blank-holder, it has four—one at each corner of the frame. This machine is to go to Milwaukee, and will be used upon the heaviest class of drawn and pressed work. It occupies a floor space 8'x8', and is 18' high. It was being tested by drawing thirty quart dishpans—two at a time, and out of the heaviest stock. There are two cranks on the shaft, which weighs 3,100 lbs.; the total weight of the machine being forty-one tons.

The new pattern storage warehouse is fireproof, and contains entirely new patterns, all the old ones having been destroyed by the fire. At one end of the office is a fire-proof vault, in which valuable papers and drawings of all the productions of the concern are kept. A great many special jobs are done here and at the New York city branch establishment, principally in the shape of various punching and drawing dies for special operations. The method of keeping

a record of such jobs is somewhat unique, and seems well adapted to the purpose, the record being kept principally by the aid of the products of the dies. Every such set of dies is, before shipment, put into a machine and tested upon the actual work it is intended for. A specimen of the work is kept, and if, to finish the piece, several operations are required, a specimen is kept for each operation. These are wired together, and with them is a tag, having upon it the necessary information for identifying the job, and in cipher the price for which the dies were made, and their cost. There is also upon this tag a rough pen sketch, sufficiently complete to show the general construction. These are then hung upon the side walls of a room over the office, and classified in groups, so that any one of them may be easily and quickly found.

One of the chief uses of this plan is to facilitate the making of estimates upon other sets of dies to make work, samples or drawings of which are sent in by customers. Such a large variety of these samples is accumulated, that, no matter what may be received as a sample piece, something is almost sure to be found resembling it, and which has been made by tools constructed in much the same manner as those required for the new job. The cost of the former set of tools being known, it is easy to estimate the cost of the new ones, making allowance for such slight changes as may be necessary.

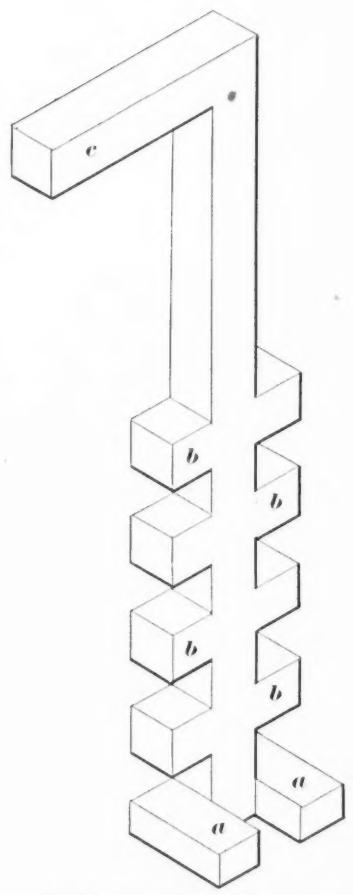
The special advantages of the plan seem to be that samples resembling the piece of work to be done are very quickly and readily found, and, when found, all the necessary information upon which to base an opinion as to the best plan for "going at" a job, and an estimate of the cost of the tools, is at hand.

Heavy castings are taken from the foundry on a truck, which runs upon rails laid through the foundry and across the open space intervening, to a room which is devoted to the planers. There are five planers, which are arranged in semi-circle in such a manner that a small swinging crane can lift a casting from the truck, and deposit it upon any one of the planers. Just outside the foundry door the rails run across the platform of scales, which are also accessible for wagons, so that castings may be weighed as they come from the foundry, and anything delivered to or taken from the works by wagons or trucks, can be driven onto the same scales.

Mr. De Neefe, who has charge of the foundry here, seems to have solved the question of flask clamps very satisfactorily, and kindly allowed us to make a sketch of the clamp devised by him, which is given herewith. It shows just one-half of the clamp, the other half being just like it; in fact, cast from the same pattern; the two parts hooking together to form the complete clamp. The body of the clamp is about 1½" square, the part *c* looking over the edge of the flask, and having wedges driven under it to tighten in the usual manner. The two projections *a a* engage with any of those marked *b* (on the other half of the clamp), according to the length desired. This does away with the necessity for having a great number of clamps around of different lengths, and with the bother of selecting the right ones. There is only one kind, and any pair of castings like the sketch which may be picked up, can be instantly put together to make a clamp of the desired length, whether it be short or long, and there being but one pattern to make, and no fitting, the foundryman can supply himself with clamps until he gets tired.

Mr. Stiles has perfected what might properly be called a machine for copying letters, to take the place of the ordinary copying press, which it is about as far ahead of as the perfecting Webb printing press is ahead of Franklin's hand press. In this machine there is a roll of the thin paper used for copying letters, which, when the machine is in operation, is unrolled and passes horizontally through water, and from thence by suitable guide rolls to a pair of rubber rolls, one of which is on top of the other, and pressed upon it by an adjustable device for regulating the pressure, substantially the same as is found in clothes-wringers. As the paper passes along towards these rubber rolls, the letters are laid upon it face down, and pass through the rolls, being taken off at the other side, the paper passing to another roll, upon which it is wound. The letters, as soon as they pass through the rolls, can be enclosed and mailed. In the morning, the roll which contains the copies of the previous day's letters is unwound by drawing off the paper through a pair of clamps, which, when they are closed down, hold it firmly, so that each copy can be torn off, and at the same time two holes are punched through it for filing. The copy can then be filed with the rest of the correspondence to which it relates, and all letters received and the answers thereto relating to any given matter are thus kept together, and are much more conveniently referred to than when the copies are scattered through one or more copy books.

No actual test of the time required to copy letters was made, but it seemed as though it would be easy to copy the entire day's production of the ordinary type-writer girl



De Neefe's Flask Clamp.

while by the ordinary process the book was being opened at the right place, and the various brushes, dishes, card-boards, etc., being got ready for operation.

The Storage Trust.

The last sweet thing in trusts is a storage trust similar to the Empire Storage Company, of Brooklyn. This octopus in embryo has not yet been fully "evolved from the inner consciousness" of the enterprising gentlemen who propose to put by this means a thumbscrew on the steamship companies and importers. The Secretary of the Treasury may step in and stop this beautiful little game by revoking the licenses for bonded stores of those who join the trust. If there is any one combination that stinks in the nostrils of the people of New York it is a trust. The city is already ridden to death by monopolies and trusts, and there may be such a thing as giving the trust thumbscrew just one turn too many.—*Marine Journal.*

Of all foolish schemes, the most foolish is that to utilize the water-power of Niagara Falls. To spoil, for the sake of a few dollars gain, what is in some respects the greatest natural wonder in the world, could only be equaled by an effort to bottle up sunshine and retail it to those who could afford to pay for it.

Erie Meeting of the American Society of Mechanical Engineers.

The president, Horace See, in his address, dwelt upon the importance of skilled mechanics in the industrial arts, prefacing his address as follows:

"With the general introduction of labor-saving devices, and the advancement of the mechanic arts, the demand for the laborer is every day becoming less and less, and that for the skilled workman greater and greater, as the drudgery of life is lifted from man and transferred to the machine, which, in its turn, demands of him skill to build and to manage.

"As a natural consequence, the supply of skilled workmen—the rank and file of our industrial army from which many of the illustrious men in our profession have sprung—is insufficient to meet the demand which our manufacturing interests, from their rapid and marvelous growth and diversified character, have created."

He argued against the teaching of trades in technical schools, and cited the fact that, in the profession of medicine, the utmost stress was laid upon practice.

Speaking of the effort to bring mechanic arts high schools into the existing system of public education, he says:

"It is not only perplexing to conceive how a trade can be taught in the manner specified, but how a boy, staggering under his load of science, technology, industrial art or commercial activity, can be brought down to such an humble pursuit, and made to work at it. The fact is that he cannot be brought there, but aspires at once to something higher. His efforts in this direction, as a rule, are unsuccessful, and cause him to drop out of mechanical pursuits."

The establishment of a free school of mechanical trades in an agricultural county at some distance from manufacturing establishments (evidently referring to the Williamson endowment), he considered as showing "how far from natural methods the teaching of the young to become skilled workmen is drifting, and seems to add another example to the many previously existing, of kind but misdirected efforts to educate them."

The advocates of the manual training system did not stop to consider how the children are to be provided for during their long period of non-production. If better education was to be given to the children whose parents possessed limited means, the night school must supply it in connection with the workshop.

He outlined another plan where the philanthropist was willing to support as well as educate. Let the boy, having a good common school education, be apprenticed for at least four years to an establishment engaged in the work he expected to follow. Four days of the week should be spent at shop work, and two in study:

"The industrial home, with its schools, should be located in the midst of a manufacturing center. The school should be well provided with all the necessary facilities for instruction in subjects bearing upon mechanical engineering, naval and civil architecture, chemistry, electricity, mathematics and drawing. For boys who are able to live at home, night schools could be provided in the same institution, taught by another corps of teachers."

James W. See presented a paper on Standards, in which he contrasted old-time methods of manufacture, where each individual article stood by itself, with the present methods of interchangeability. He argued the necessity of standards that should be universal, and gave a formidable list of articles which should be made standard.

His proposition was in effect that a governmental bureau of standards should be established, in which any respectable representation of a trade could file a standard. Governmental oversight would insure more accurate definition of standards, guard against confusion, and provide for any interested party obtaining an accurate description of it.

To bring about what was desired, the following enactments would be required:

"*First.* The establishment of a Division of Standards as a subordinate division of the Patent Office.

"*Second.* The provision that any respectable representative body of any craft, trade, vocation or business, having, by due deliberative proceedings, adopted a standard, and having duly appointed a committee to attend to the Government filing of said standards, may, upon due proceedings, file such standard in the Patent Office, and thereupon such standard shall be known as the United States Standard.

"*Third.* Each standard, as filed, should have a consecutive number.

"*Fourth.* Provision should be made by which articles represented as conforming to the established standard may, if desired, be so marked in a brief manner, and to this end a symbol should be legalized, say, as a mere example, Ⓛ. This device upon an article, followed by the standard number, would be equivalent to saying, 'This car axle has its bearings in conformity to U. S. Standard, No. 728.' * * *

"Most every branch of industry now has its representative association, and in most cases its representative periodical literature. It is suggested that the American Society of Mechanical Engineers assume the general burden of the matter in the following series of steps:

"*First.* A well-formulated resolution expressing the object, desirability and nature of the scheme, such resolution to take the form of a memorial to Congress.

"*Second.* The appointment of a permanent committee to promote the scheme.

"*Third.* The preparation by that committee of a roster of all American associations likely to be interested in the project, or to have influence in furthering it, such roster to show the meeting dates, etc., and, if possible, the names of a few distinctively enterprising members who would be apt to appreciate the matter in hand.

"*Fourth.* The preparation by the committee, of a schedule of subjects within the range of each of the associations, which subjects would properly lend themselves to treatment under the proposed system of standards.

"*Fifth.* The preparation by the committee of a brief argumentative paper for each association, to be accompanied by the appropriate schedules.

"*Sixth.* The preparation by the committee of a resolution for each of the associations, similar to the initiating resolution adopted by the American Society of Mechanical Engineers.

"*Seventh.* A presentation by the committee of the appropriate resolution, schedule and argument, to the selected enterprising members of the various associations, with a view to enlist such members in such procedures in their society as will secure the adoption of the resolution, and the transmittal of a duly authenticated copy thereof back to the committee of the American Society of Mechanical Engineers.

"*Eighth.* The preparation of a general argument for committee use in Congress.

"*Ninth.* The presentation by the committee of all said resolutions, as a general memorial to Congress, through the medium of any selected Senator or Representative, together with the argument.

"*Tenth.* Personal argument by the committee before Congressional Committees, when required.

"*Eleventh.* The presentation by the committee, of the matter to the President for executive recommendation, coincident with or prior to the presentation of the matter to Congress."

De Volson Wood presented a paper on "Expansion of Timber due to the Absorption of Water." The experiments were made at Stevens Institute, the object being to determine how much timber would expand in the direction of its fiber. Two specimens each, of pine, oak and chestnut were selected, each about three feet long and six inches wide. The specimens were to be fairly seasoned, and then kept in a dry, warm room for about three weeks. They were then immersed in water for twenty-seven days. The mean per cent. of elongation of the pine was 0.06½ per cent.; of the oak, 0.08½ per cent.; and of the chestnut, 0.16½ per cent. The lateral expansion was, pine, 2.6 per cent.; oak, 3.5 per cent.; and chestnut, 3.65 per cent.

J. Burkitt Webb presented a "Note on the Steam Turbine," from which we extract the following:

"When steam flows out from under a considerable pressure, it attains a very high velocity. In the production of this velocity the steam expands from the high to the low pressure, and the mechanical energy thus produced, and existing in the form of kinetic energy in the moving steam, would seem to be obtained with a high degree of economy. The problem, therefore, is to some extent the same as in a water turbine, having given a stream of fluid at a certain velocity, to abstract as much as possible of the energy from it, by allowing it to react upon a moving wheel. Now, the primary condition of economy is that the fluid shall leave the wheel with only enough velocity left in it to get it

out of the way; and, in the case of the steam turbine, this requires an almost, if not quite impracticable velocity for anything like a great difference of pressures.

"The subject not only includes a consideration of that form of passages through the wheel, which will allow it to move with the least velocity, but of the best method of constructing it to resist centrifugal force, and how to balance and lubricate it. The advantages of a successful turbine are too apparent to need mention, and I hope to hear of progress in this direction."

L. F. Lyne presented a supplementary paper on "The Use of Crude Petroleum in Steam Boilers." He detailed experiments with crude petroleum in a test with kerosene, for preventing scale. His conclusions were that the crude petroleum was of but little use, if not a positive disadvantage.

He also presented a paper in which he emphasized the evil effects of not counterboring cylinders traversed by a piston, and made the somewhat remarkable statement that steam engine cylinders were sometimes made at this day without counterbores. The following was his plan for fixing an engine cylinder that had worked loose:

"The engine, when first set up, rested on a bed of sulphur, against my remonstrance; but we were told that there were hundreds of steam engines set in the same way. The thickness of sulphur between the feet on the cylinder and the stone capping on the foundation was $\frac{7}{16}''$. After two years of service, the sulphur began to disintegrate and work out. The engine had to run every night, so whatever we concluded to do in the line of repairs had to be done between the hours of 7 A. M. and 4 P. M. For information I asked about a dozen engineers of my acquaintance as to what they would do under the circumstances. The answers I received have induced me to put this in print, for I would have been very grateful had any one told me offhand of the method that I employed to secure this engine permanently on the foundation. One friend says, "Make a rust joint," forgetting that it takes three or four days for a rust joint to harden sufficiently to be sure that it would not disintegrate and come out. Another says, "Put in cement," knowing full well that cement requires a week or ten days to become hard. Still another says, "Wedge up the cylinder and run in cement and let the engine rest on the wedges until the cement hardens." He knew that wedges are the worst things that could possibly be used to support a piece of machinery that is constantly vibrating, for they do work loose. Finally one friend says, "Put in more sulphur," arguing that it would last as long as the original, which was certainly good logic; but this did not suit me, for I wanted to make a permanent job of it.

I went home and meditated, and the next morning I went to the machine shop and had four pieces of flat-iron $4''x\frac{1}{2}''$ cut off. These I reduced in thickness so as to just fill the space between the top of the cap-stones and the cylinder feet. I dug out the sulphur by the side of each anchor bolt, of which there were four, two in each foot; I slacked the nuts of the foundation bolts, then put in my liners, one for each bolt, and screwed them fast.

The sulphur was then removed from one foot at a time, and the space thoroughly scraped out. We then took two strips of lath and wrapped sufficient paper around each of them to fill the space between the stone and foot, thus dividing the space into three equal parts. This was done because it would take more metal to fill the space than could have been conveniently handled. We placed strips of lath edgewise all around the foot and backed them with fireclay. An opening was left at each of the four corners—two for risers and two diagonal corners for pouring metal—leaving a head of about two inches to better ensure a solid casting. Some powdered rosin was thrown into the gates to absorb the moisture and prevent the casting from blowing. Having previously melted in an iron pot a mixture composed of nine parts of lead, two of antimony, and one of bismuth (commonly known as expansion metal), we poured from two ladles, and in about ten minutes had the satisfaction of finding that our cylinder was as securely held as if it had been originally bedded on the solid stone. We poured the outer spaces of each foot first, then removed the two strips of lath and poured the middle space, the two outside castings forming the dam preventing the metal from running out at the sides. No one who has seen it doubts that this cylinder is fixed forever."

Scott A. Smith presented a paper on "Tractive Force of Leather Belts on Pulley Faces." His conclusions were that the best belts are made from all oak tanned leather, curried with the use of cod oil and tallow. Leather so tanned, contained no free oil, which would, if of animal or vegetable origin, have a tendency to generate free acid injurious to the fiber, the pulley and belt.

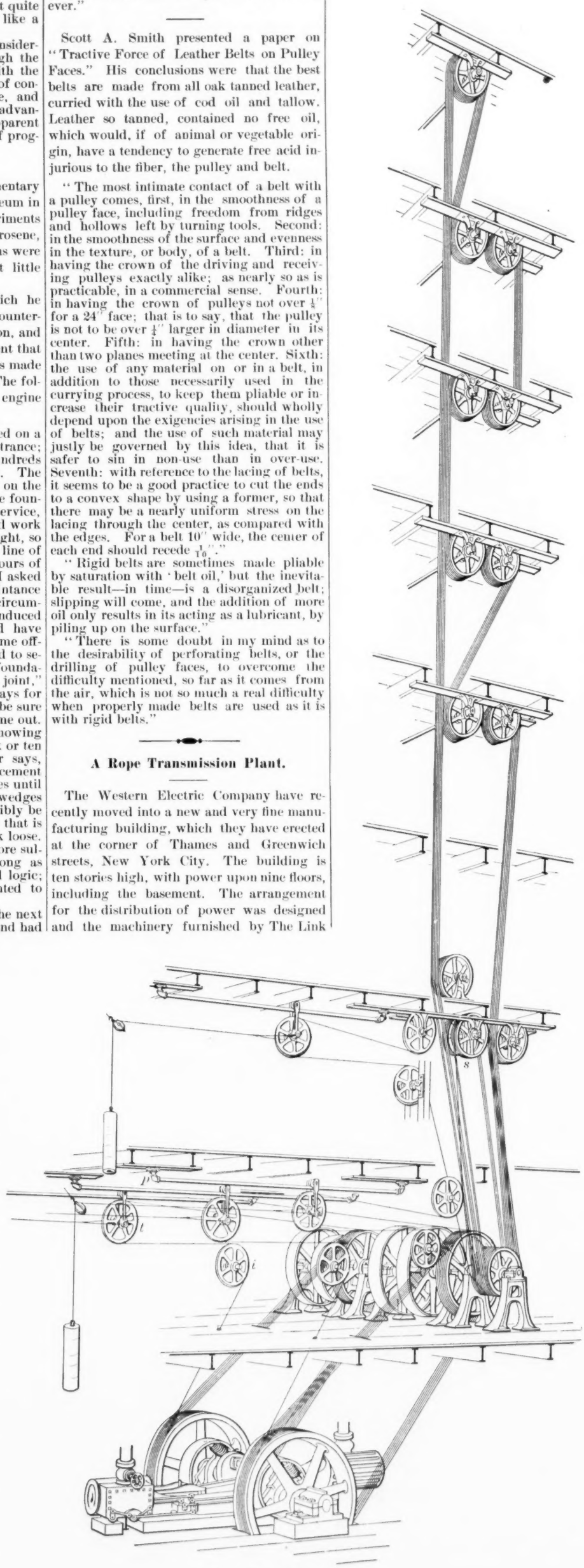
"The most intimate contact of a belt with a pulley comes, first, in the smoothness of a pulley face, including freedom from ridges and hollows left by turning tools. Second: in the smoothness of the surface and evenness in the texture, or body, of a belt. Third: in having the crown of the driving and receiving pulleys exactly alike; as nearly so as is practicable, in a commercial sense. Fourth: in having the crown of pulleys not over $\frac{1}{4}''$ for a 24" face; that is to say, that the pulley is not to be over $\frac{1}{4}''$ larger in diameter in its center. Fifth: in having the crown other than two planes meeting at the center. Sixth: the use of any material on or in a belt, in addition to those necessarily used in the currying process, to keep them pliable or increase their tractive quality, should wholly depend upon the exigencies arising in the use of belts; and the use of such material may justly be governed by this idea, that it is safer to sin in non-use than in over-use. Seventh: with reference to the lacing of belts, it seems to be a good practice to cut the ends to a convex shape by using a former, so that there may be a nearly uniform stress on the lacing through the center, as compared with the edges. For a belt 10" wide, the center of each end should recede $\frac{1}{10}''$."

"Rigid belts are sometimes made pliable by saturation with 'belt oil,' but the inevitable result—in time—is a disorganized belt; slipping will come, and the addition of more oil only results in its acting as a lubricant, by piling up on the surface."

"There is some doubt in my mind as to the desirability of perforating belts, or the drilling of pulley faces, to overcome the difficulty mentioned, so far as it comes from the air, which is not so much a real difficulty when properly made belts are used as it is with rigid belts."

A Rope Transmission Plant.

The Western Electric Company have recently moved into a new and very fine manufacturing building, which they have erected at the corner of Thames and Greenwich streets, New York City. The building is ten stories high, with power upon nine floors, including the basement. The arrangement for the distribution of power was designed and the machinery furnished by The Link Belt Machinery Co. of Chicago, and is illustrated herewith.



ROPE TRANSMISSION PLANT.

In the basement are two engines built by Russell & Co., Massillon, Ohio, and rated at 175 horse-power nominal each. The cylinders are 18"x27", the engines running 125 revolutions. The fly-wheels are 10 feet diameter, and have six grooves for a one-inch rope. The ropes are of raw-hide, and wind continuously around the pulleys from groove to groove. As the rope leaves the fly-wheel at the left-hand side, it runs over an idler *i*, and from thence to a tightener *t*, which is suspended in such a manner as to be drawn back by the weights as shown. The arms which support the tighteners are hung from rollers, which are grooved to fit the surface of a section of extra heavy wrought-iron pipe *p*, upon which they roll. From this tightener the rope passes direct to the right-hand groove of the pulley on the main shaft above the engine, the tightener pulley being inclined sufficiently to make the bottom of it come in line with the left-hand groove, while the top comes in line with the right-hand groove. The main pulleys which drive the shaft above the engines are mounted upon and keyed to sleeves ten inches diameter, which extend out on each side far enough to form journals by which they are supported in pedestals independently of the shaft. Through the sleeve is a hole considerably larger than the shaft which passes through them, and is supported by separate pedestals. One end of each sleeve is so formed as to make in connection with a sliding collar which is on the shaft, a positive interlocking clutch, which can be thrown in or out by a lever. In this way both engines may be working at the same time, or the shaft may be run by either engine alone, the other pulley standing, and imposing no friction upon the shaft. All the bearings of this shaft are adjustable laterally by set screw, and vertically by wedges. The other large pulleys upon this shaft are driven by friction clutches, and are used for driving dynamos, each pulley driving two dynamos arranged "tandem," one belt running over the other. This shaft runs at 220 revolutions, and is $4\frac{1}{4}$ inches diameter.

At one end of the main shaft is a pulley having twelve grooves, in which run two ropes, which run side by side to the top of the building, and around the various pulleys down again. Either of these ropes is calculated to be amply strong enough for the work, but two are used to avoid the necessity for stopping, should one break. Each of them winds three times around the pulleys, thus giving six driving strands. To avoid crowding, the tightener for one of these ropes is placed upon the floor above the other. The ropes pass from the main pulley three times around the pulley *s*, and then go to the top floor and down as indicated.

From the shaft *s* the wood-working machinery, blowers for the foundry, and some of the elevators are driven, the other lines being used for driving light machine tools, such as are used in making electrical apparatus.

On each floor is a friction clutch cut-off coupling, by which, in case of an accident, on any floor, the power can be cut off without interfering with any of the other floors.

The ropes run very smoothly and quietly, and the entire arrangement seems well adapted to the purpose it is to serve.

Crossed the Atlantic in Less than Six Days.

The Inman steamship City of Paris, which arrived at New York May 8, made the passage from Queenstown in five days, twenty-three hours and seven minutes, thus beating the best previous record—that of the Etruria—by two hours and forty-eight minutes. For three successive days the average run was $506\frac{3}{8}$ miles, 511 being the greatest run in twenty-four hours; this is $21\frac{7}{24}$ miles per hour.

Engineers and shipbuilders in England and Scotland are well stocked with work, and in nearly every industry the tendency of wages is upward.

LETTERS FROM PRACTICAL MEN.

Connecting Steam Drums to Boilers.

Editor American Machinist:

Mr. W. H. Booth's position upon the safest practical method of connecting steam drums with domes or boilers is worth the attention of all concerned, and those who are concerned do not comprise a small constituency.

Mr. Booth advises that such connections be made of boiler plate, with flanges double-riveted it is supposed. I infer that he objects to the rigidity of cast-iron for such a purpose, and the nature of the metal as compared with plate metal, he argues, does not confer the margin of safety required. Mr. Booth may be right. His experience points that way ; mine this way : I know personally of many steam boiler plants where the original method of connecting drums with boilers was always by wrought-iron or boiler-plate nozzles, but after a use of ten or more years, in which regular calking, and sometimes fitting new nozzles was required, some man conceived the idea of putting cast-iron there.

I think he reasoned in this way :

The line of action with this structure—this long drum, 30″ in diameter, with its ten or twelve connecting nozzles or branches—seems to be of such a nature that a great strain is exerted upon the rivets and joints. We found that single riveting would not hold them well, so we put in a double row of hammered buttons, and still they didn't keep tight. Now, our philosopher continues, the inference is that this lifting strain or elongation, or line of action, is so severe that this comparatively elastic iron fails to satisfactorily do the expansion and contraction act. I'll throw away the outfit and put in cast-iron.

What a contradiction ! What a paradox ! Looking for elasticity in cast-iron. But hear him for his cause. I, this philosopher continues, will proceed in this manner : I will rivet a circular piece of heavy boiler plate on that shell, large enough and wide enough to give me a good, firm bearing for my cast-iron nozzle, will fit that well on its lower concave flange, rivet it well from the inside, and do my calking also inside. Now this job will be done on each boiler. I will have corresponding branches on the drum put on in like manner. My bolt flanges on each nozzle will be faced in the planer ; and when I place the drum upon its supports those faces must fit, or I will make them fit, so that corrugated copper wire, one ring or two to each joint, or sheet asbestos $\frac{1}{16}$″ in thickness, will make a joint, and an everlasting joint.

Well, now I say to our genius with the new idea : you ought to be happy now, Mr. Tareup, you've got cast-iron; but where does your "spring" come in ?

He tells me he has *transferred* the spring. Has taken it from all plate flanges, and their double rivets, and has put it upon that course of the boiler shell upon which each nozzle is fastened. He says that cast-iron connection is so rigid that it takes hold of the wide boiler sheet as no other fastening can, and that the *spring* is natural and easy. Is the philosopher correct in his deductions ? What do I say about it ? This : I have seen those fastenings in hard service for a period of ten years, and every joint about them is tight as a bottle. If this practice is wrong, it is hard to find what is right. D. W. L.

Self-Instruction for Young Mechanics.

By FRANK RICHARDS.

VII.

Generally, in drawing machines or parts of machines in isometric projection, no plane projection, for the purpose of getting construction lines, or of locating points, will be needed, as there will be rectangular lines in the thing represented, with which any oblique lines that occur will be in contact, or to which they can be referred.

Here is a horse, a familiar quadruped of the shop, Fig. 1. To draw it nothing is needed but the single projection and such construction lines as we can readily locate by it. We need the measures of the parts, of course, but those we need in any case. The body of the horse is rectangular, and we draw the entire outline of it according to our scale, the parts out of sight being in pencil in our drawing, and shown here by dotted lines.

It occurs to me, just here, that we ought to have a name, as a labor-saver, by which to designate the three normal isometric lines, *A*, *B*, *C*, Fig. 2. The vertical is, of course, self-named. The other two we may call the right isometric line, *A*, and the left isometric line, *C;* and so I use them.

Well, from the center of the near end of the body of the horse we drop the vertical line *a b*, the length being equal to the height of the horse. Then from *b* we draw the right isometric line *b c*, which will be the center line of the base. Along this center line we measure and mark the four points *e*, *i*, *o*, *u*, corresponding with the same points upon the top of the horse. Through each

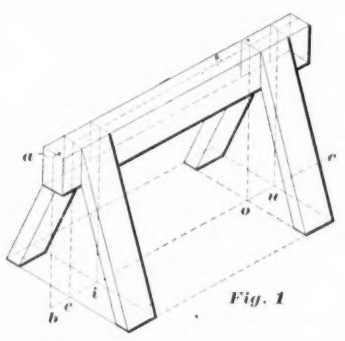


Fig. 1

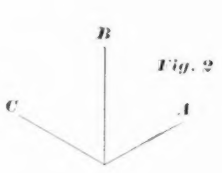


Fig. 2

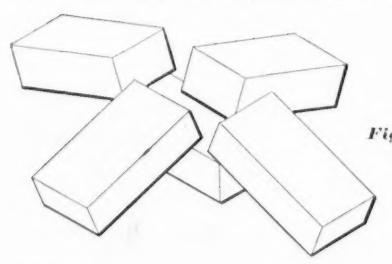


Fig. 3

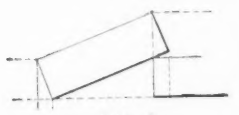


Fig. 4

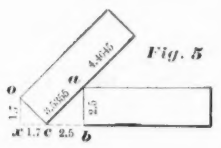


Fig. 5

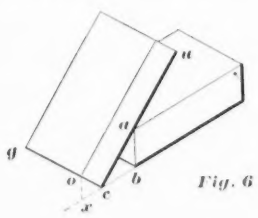


Fig. 6

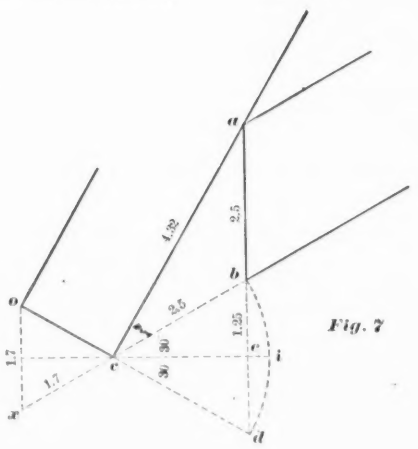


Fig. 7

of these we draw a left isometric line, and space one of them equidistantly upon both sides of the center line, the sum of the two measures being equal to the spread of the legs at the base. Then by two right isometric lines we carry these same measures of the first left isometric line to the other three of them. The vertical lines at the sides of the body where the legs meet it are then to be indicated. We have now all the marks necessary to complete the horse, which we proceed to do by drawing the remaining lines. The outer corner lines of the legs being drawn, the inner lines are simply drawn parallel to them, and meeting the body at the under corner of it.

The phenomenon regarding the change of oblique dimensions is again here to be observed. The length of the front legs is too long, and the length of the back legs is too short. This is not at all due to the distance that they stand from the eye, as would be the case in true perspective, but is entirely on account of the different angles at which the legs stand. There seems to be a law of compensation in the matter, too, for, where the leg is elongated it also becomes thinner, and where it is shortened it becomes thicker.

Here are four bricks, Fig. 3, placed centrally and rectangularly, and at the same angle of inclination upon the two edges and the two ends of a brick lying flat upon its side. This is an easy thing to draw, the only assistance required being one elevation, Fig. 4, of the reclining brick, from which all necessary measures may be taken. All four bricks reclining at the same angle, the bottom corner of each is at the same distance from the under brick, and the upper corners are all of the same height. Fig. 3 shows rather strikingly, I think, how the isometric projection may change the appearance of an object. The bricks at the back would scarcely be accepted by the uninitiated as identical in size and position with those in front.

In practical drawing, the same as in machine work, in the preliminary construction of a machine upon paper, as in the actual work of the shop, the faculty of invention is always in play. Different ways of doing things are always to be thought of, for it is seldom that the best is thought of first. As I believe in wringing things as dry as possible, as I always advocate the getting as much as possible out of everything before leaving it, I may be permitted to follow the practice that I advocate, and bring up what we had in our last number again. In the drawing of the brick, Fig. 5, inclined at 45°, instead of drawing any of the dotted construction lines, as we did before, except the base line, we could have got all the required points by arithmetic; by the arithmetic of the common school that the mechanic should carry into the shop with him when he enters it. I always say, as I always believe, that arithmetic is as valuable to the mechanic as any tool he can have, and, like all his tools, it is not of much use to him, and it does not speak well of him if it is allowed to get rusty. So it will be good for it and for us if we brighten it up a little by exercising it in this case. This will give us quite a neat little job in arithmetic, bringing into play the three most important arithmetical operations the mechanic has to use : the extraction of the square root, finding the third side of a right-angled triangle, and simple proportion. I would like to say more about machine shop arithmetic by and by, if we travel together so far, but just now we will stick to the brick case.

The angle of inclination, Fig. 5, being 45°, *b c* must be equal to *a b*, and in Fig. 6 we can measure off *b c* and then draw *c a*, and prolong it upwards beyond *a*, as far as may seem necessary. This will be the lower line of the inclined brick, but not being an isometric line we cannot measure off the length of the brick by our scale. We first find the length of *a c* in Fig. 5. This is the hypothenuse of the right-angled triangle *a b c*, so we get $2.5^2 + 2.5^2 = 12.50$, and $\sqrt{12.50} = 3.5355$, the length of *a c*. Then the length of the remainder of the brick will be $8 - 3.5355 = 4.4645$. Now this, instead of being the end, is only the beginning. The length *a c* in Fig. 5 is correct according to our scale, but in Fig. 6, while *a c* represents the same portion of the total length of the brick as *a c* in Fig. 5, its actual length is not the same. It is evidently longer, and we want to find what its actual length is. To show this comfortably, and to give us room to move around without hitting anything, we draw this on a larger scale, Fig. 7. Now, from *c* as a center, with the radius *c b*, we draw the arc *b i d* and the line *c d*, making the angle *i c d* 30°, the same as we know that the angle *i c b* is. If we have been studying our geometry, as I assume that we have been, we know that *b d* is equal to *c b*, and consequently *e b* is equal to one-half of *c b*, or 1.25. Then from the right-angled triangle *b e c* we get $2.5^2 - 1.25^2 = 4.6875$ and $\sqrt{4.6875} = 2.16$, the length of *e c*, and from the right-angled triangle *a e c* we get $(2.5 + 1.25)^2 + 2.16^2 = 18.7281$, and $\sqrt{18.7281} = 4.32$, the actual length of *a c*. But this actual length (by the scale of the drawing) of *a c* represents only 3.5355, and if 4.32 represents 3.5355, what will represent 8, the total length of the brick ? This we find by the simple proportion : 3.5355 : 8 : : 4.32 : ? and solving this we have $8 \times 4.32 \div 3.5355 = 9.77$. This 9.77 then will be the length *c a u* in Fig. 6.

To complete the brick we have now to locate the point *o*, after which the remainder of the figure is determined by lines drawn parallel to those already made. In Fig. 5 *o x c* being a right-angled triangle, and the angle *o c x* being, as we know, 45°, and the side *o c* opposite the right angle being 2.5, we get $\sqrt{\frac{2.5^2}{2}} = 1.7$, which will be the length of both *o x* and *c x*. These lines will be, in Fig. 6 or 7, true isometric lines, and drawing them according to our scale gives us the point *o*. From this we draw *o g* to scale, and then the parallel lines that finish the brick.

The Yost Writing Machine.

(CORRESPONDENCE).

In a recent issue, Mr. G. I. Francis makes some suggestions about the Yost writing machine, which we have not yet seen answered in your columns. We hope Mr. Francis has or will make a personal examination of the machine; meantime, it is fair to say that the points he raises are important ones, upon which the question as to our principle being a genuine improvement, hinges.

He suggests the difficulty of making type in large quantities with beveled faces to accurately fit the guide. These type are turned out by the thousand set at a small cost, and with a degree of accuracy which is nearly equal to that in printers' type.

He suggests that in using different thicknesses of paper, that is, from ten to fifteen sheets at a time, the type-bars would not bed home to the surface of the guide. A trial of the machine on this point would show that the last part of the type-blow is practically straight and without lost motion; and an experiment in manifolding this number of copies will exhibit perfect alignment, which, in fact, cannot be accomplished in any of the other type-bar machines.

He suggests that if ink or dirt gets caked onto the type, this would prevent alignment. He is correct; dirt brings all sorts of evils in machinery, although the liability to anything of this kind in our machine is extremely small; the type rest against the pad, so that dust cannot enter their faces. The ink has much more of an affinity for the pad than for the type, and there is never such a thing as the gumming of the ink in the type.

He suggests that the most used letters would wear quicker than the others, from the constant pounding of the beveled surfaces, and so get out of alignment. This last criticism shows that your correspondent has not examined the machine; he is evidently under the impression that it is the face of the type which strikes the guide; sufficient to say,

therefore, that under no circumstances can the faces of the type strike the guide or each other, or any part of the machine, unless by a violent distortion of the type-bars especially intended to produce that effect.

The subject of "forced alignment" has never been tried in the manner exemplified in the Yost machine.

Lest some of your readers may imbibe unfair opinions from Mr. Francis' unanswered suggestions, we submit the above for your consideration, and insertion if you deem proper.

MUIR, HAWLEY & MAYO CO.

Modern Locomotive Construction.

BY J. G. A. MEYER.

NINETY-FIRST PAPER.

Figs. 504, 505 represent another throttle pipe, and Figs. 506, 507, 508 show some of its details. The design of this throttle pipe does not differ much from those previously shown. The principal differences are that the pipe is made in one piece, and that the sleeve *I* is of a different form, as previously shown. The manner of fastening the dry pipe to the throttle pipe is plainly shown, and does not need any further explanation.

The favorite way of fastening the throttle pipe to the dome is plainly shown in these figures. A bracket *D* is cast to the throttle pipe, and fastened to the dome sheet *V* by two studs. When possible, all dry pipes are allowed to rest on top of the crown bars. When this cannot be done, the dry pipe is suspended by a strap, usually made of 2 x ½-inch iron, bolted to the boiler shell *W*.

The thickness of the throttle is generally about ½ to ⅝ of an inch.

Fig. 504 represents a pipe exceptionally thin, the thickness being only $\frac{5}{16}$ of an inch; and for this reason the thickness at the lower end is increased, so as not to injure the casting in clamping the dry pipe to it.

The inner diameter of the throttle pipe is generally made proportionate to the diameter of the cylinder; the ratio between the two, as made by different builders, varies. Hence we sometimes find the inner diameter of the throttle pipe equal to one-quarter of the diameter of the cylinder, and frequently we find it to be equal to about one-third of the diameter of the cylinder. The latter we believe to be the best proportion, and should be adopted. When the inner diameter of the throttle pipe is not uniform throughout, for instance, if the throttle pipe is made similar to that shown in Fig. 504, the smaller diameter

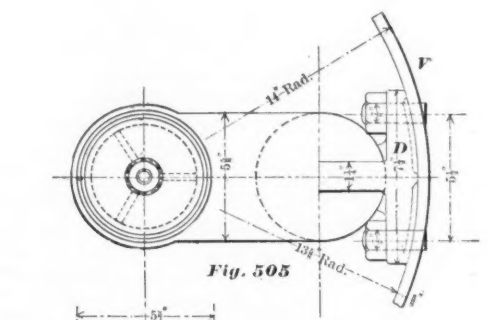


Fig. 505

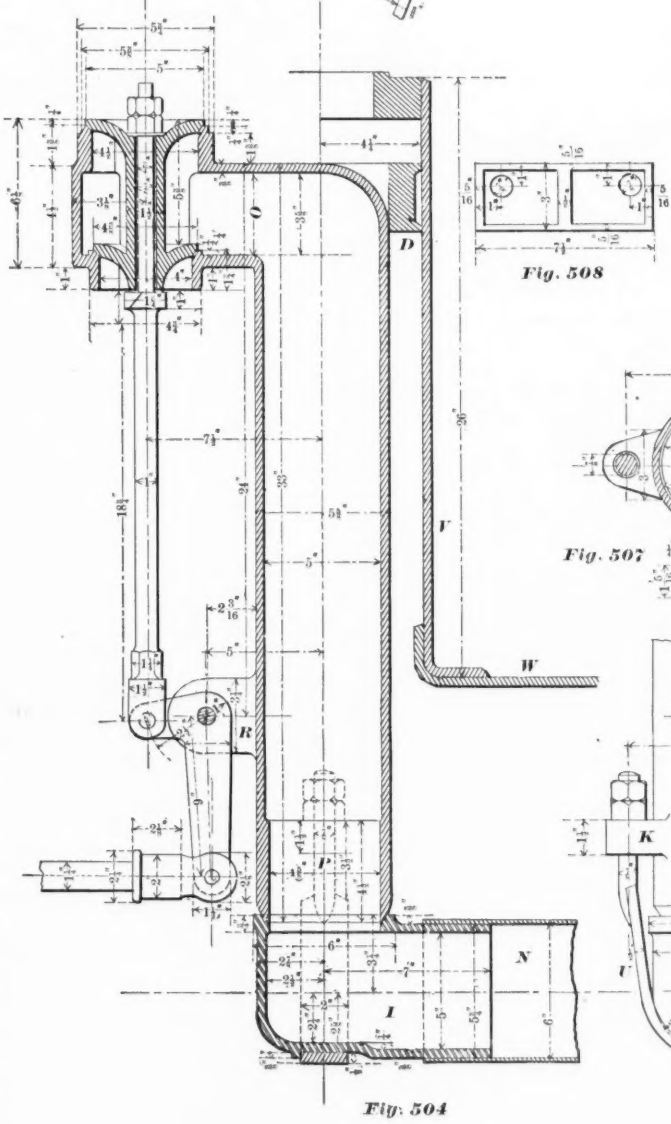


Fig. 504

Fig. 508

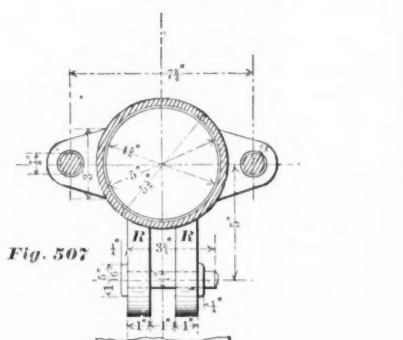


Fig. 507

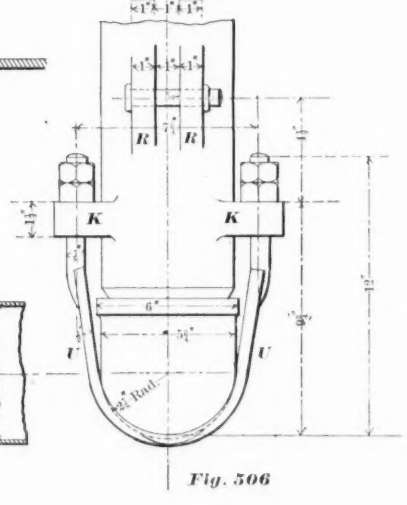


Fig. 506

pressure more than it would be otherwise, and the tractive power of the engine will be interfered with. On the other hand, practice seems to indicate that no advantage is gained by making the inner diameter of the throttle pipe greater than one-third of the diameter of the cylinder; in fact, throttle pipes and dry pipes too large in diameter are detrimental through the cylindrical portion of the pipe.

The inner diameter of the dry pipe should be equal to that of the throttle pipe; but since in many cases the diameter of the pipe, determined by calculation, cannot be found among the standard diameters of dry pipes, the next larger size is adopted; and therefore we often find locomotives having dry pipes whose inner diameters are greater than those of the throttle pipes.

The outer diameter of the upper disk of the throttle valve is sometimes a little greater than the inner diameter of the throttle pipe; frequently it is less. A good rule is to make the outer diameter of the upper disk equal to one-third of the diameter of the cylinder. The outer diameter of the lower disk is made from ⅛ to ¼ of an inch less than the diameter of the upper opening in the valve seat.

for small engines, say with cylinders 10 inches diameter, the rivets through the ring B_2 are generally ⅝ inch diameter, and the studs ⅝ inch diameter; for engines with cylinders 20 inches diameter, rivets ¾ inch diameter, and studs 1 inch diameter are generally used. The flue sheet *A* is bored out to receive the projection on the brass ring B_2. The spherical seat in this ring is made to fit the spherical surface on the sleeve *J*; this sleeve, we have seen in our last paper, is riveted to the dry pipe *N*. The T pipe has a spherical projection *p*, bearing against the surface of the counter bore in the sleeve *J*; some builders make this counterbore a conical surface; others make it a spherical surface as shown; but in all cases, the projection *p* on the T pipe is turned to a spherical form.

The diameter of the opening *R* in the brass ring must be made sufficiently large to admit the sleeve on the other end of the dry pipe; this condition will determine to a great extent the size of the ball joint on the sleeve *J*. It will be seen that the studs *F*, *F* force the T pipe against the sleeve *J*, and the latter is, in turn, pressed against the ring B_2, and thus forming steam-tight joints between the whole.

Some builders do not use a brass ring B_2 for small locomotives, but use in place of it a wrought-iron plate *P P*, as shown in Fig. 512. In fact, some master mechanics prefer the wrought-iron plate *P P* for all sizes of engines, and consequently we frequently meet with large engines which have a plate of this kind in place of the brass ring. The plate is riveted to the flue sheet *A A*; the arrangement of rivets and studs for holding the T pipe is similar to that in the brass ring as shown in Fig. 509. Both the flue sheet and the plate are then counterbored as shown, so as to form a bearing for the spherical projection on the T pipe.

The right-hand side of Fig. 511 represents an outside view of the T pipe, and the left-hand side represents a section of the connection of the T pipe and the steam pipe *D*. The steam pipes lead to the cylinders. A complete drawing of these pipes, and their position in the smoke-box, will be found in Figs. 24, 25, ninth paper. In fact, the illustrations given in this paper simply show in detail and to a larger scale, the connections of the dry pipe, T pipe and steam pipes.

The openings in the flanges *E E* of the T pipe are counterbored to a spherical form for the brass rings *C*, which are inserted between the T pipe and steam pipes. Usually, two bolts *G G* are used for connecting each steam pipe to the T pipe.

The inside diameter *K* of the T pipe

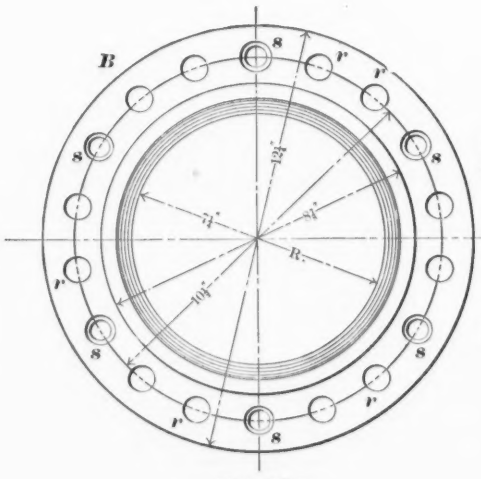


Fig. 509

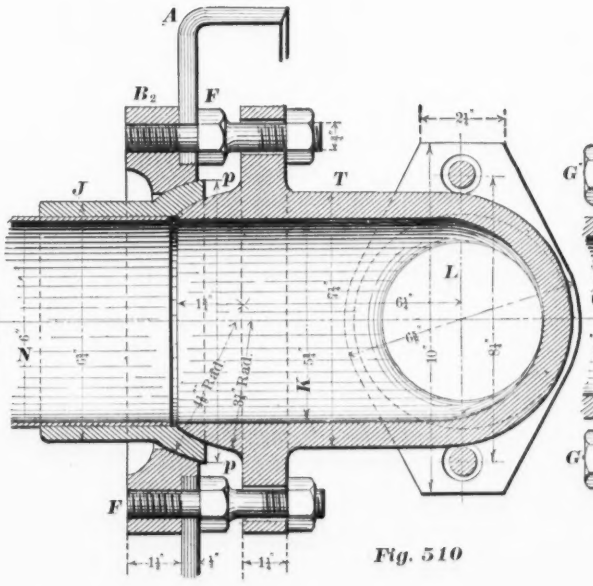


Fig. 510

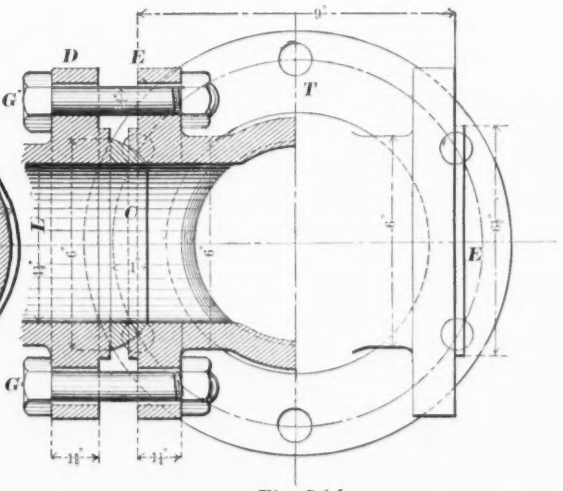


Fig. 511

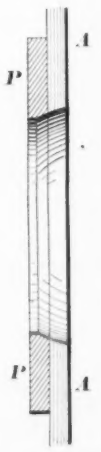


Fig. 512

P should be equal to about one-third of the diameter of the cylinder. The inner diameter of a throttle pipe should not be greater, in any case, than here given. If made much smaller, so that the cross-sectional area of the throttle pipe is less than one-twelfth of cross-sectional of the area of the cylinders, the initial steam pressure in the cylinders at high speeds will be reduced below the boiler ments to the engines, because an unnecessary quantity of steam held in these pipes must be worked off before the engine can be stopped, which is an objection in a case of an emergency.

The cross-sectional area at *O*, Fig. 504, is generally rectangular in form; the length and breadth of this section should be so proportioned as to give an area equal to

Fig. 510 represents a complete sectional view of the connections of the T pipe and dry pipe *N*. The brass ring B_2 is riveted to the flue sheet *A*; another view of this ring is shown in Fig. 509. The six holes marked *s*, *s*, in Fig. 509, are tapped for the studs marked *F F*, in Fig. 510; the remaining holes *r*, *r*, are the rivet holes. The size of rivets and studs vary according to the size of engine; must be equal to that of the throttle pipe. The area of the opening *L* in the branches of the T pipe should be equal to the inner cross-sectional area of the steam pipe. The rule for finding this area has been given in the ninth paper.

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Leaving the Old Shop.

A writer in one of our mechanical contemporaries argues against what he calls "the grave error often made by many firms in not keeping their apprentices after they have become journeymen, in preference to hiring new men." Now, it is curious, perhaps, but we think it is usually a grave error, both on the part of the apprentice and his employers, to suppose that there is any advantage to either in a continuance of their relations after the expiration of the apprenticeship.

The spirit which dominates the apprentice is usually entirely different from that which inspires the journeyman—necessarily so, and it is very rare that a young man can, at the expiration of his apprenticeship, remaining in the shop where it has been served, change his habit of dependence upon others for assistance in tight places, his way of doing things more with a view to learning than to the accomplishment of work, and his general feeling that he is a fixture in the shop, and is kept there more by reason of a specified agreement, or some indistinctly defined claim, which he dimly imagines himself to possess, than upon the sole basis of valuable services rendered. It is safe to say that the first year or two after the expiration of his apprenticeship, spent among strangers in other shops, and at somewhat different work from that which he has been accustomed to, are the most valuable years in the experience of a young mechanic. It is then that he is thrown upon his own resources and compelled to depend upon himself, which is the only way in which he can hope to make a fair comparison between himself and other mechanics, and acquire a clear idea of his own inherent ability and value. It is during this experience that he ceases to be a boy and becomes a man, realizing that the position he is finally to occupy amongst other men will depend mainly upon himself, of course largely upon the opportunities which may present themselves, but mainly upon how those opportunities are utilized.

It is a practical recognition of the fact that there is something lacking in the training of a young mechanic who has merely served out the term of his apprenticeship, which makes it almost impossible for him to secure as good wages by remaining in "the old shop," as he can secure by going out and taking a position elsewhere.

Viewed from the side of the employer, the journeyman from another shop, even though he be a young man just out of his apprenticeship, is more valuable, not only because he expects to depend for his success entirely upon his own resources, expecting no favors not received by others, but because he brings new ideas which are likely to be valuable.

We think that the prevalent practice of exchanging young journeymen, which—though mainly without design—has been followed in this country, has been an important factor in the development of our mechanics, and has been beneficial to all concerned. We have known cases, of course, where young men have remained as journeymen in the shops where they learned their trades, and have risen in them to positions of responsibility, which they have filled with credit to themselves and to their employers, but such cases are comparatively rare, and it is safe to say that in almost every instance the young man would have been all the better for some outside experience, no matter how valuable without it.

Are There Too Many Holidays?

An editorial writer in *Mechanical Progress*, an English technical journal, complains that there are too many holidays. He sums up their number, and says: We find that at least one month in the twelve is entirely *wasted* in holiday-making. He contrasts England in that respect with this country, in which he finds only three holidays, with a possible five, including Christmas and New Year's. But he fails to note that the American workman has long since—we think wisely—refused to be content with three holidays, and in one way and another he gets nearly the full dozen, as in England. And if that is all the days off that a workingman gets in the year, we should say he got few enough. When a man can look ahead to nothing but shaking hands with his work—in the majority of cases exceedingly monotonous—every working day in the year, his prospects are not particularly inviting.

This writer reasons that the observance of these holidays breaks up the continuity of work in factories and workshops, and results in loss to the proprietors. No doubt if it were admitted that the chief end of a man was the production of the greatest number of yards of cloth, or pounds of pig iron, in the fewest consecutive days, it would be a good thing to abolish holidays, including Sunday. But that is not the chief end of man; if it were, life would be a stupendous failure.

We fancy this writer is very near getting at the trouble when he refers to "Blue Monday," often extended to cover a day or two succeeding it. While no man should plod along eternally doing one thing, and thinking about it, it is true that he must devote the greatest part of his time to the business of getting a living. And Sunday, the greatest of all holidays, should be so spent as to give him a zest for Monday's work. Persuade men of this fact, and the number of holidays will be found few enough. If workingmen need to be persuaded of this fact more than others, it is because in their case temptation is greatest at this time. Blue Monday comes to many others, without much reference to the calendar.

A Copyist's Defense.

In our issue of February 28 we referred to a case of wholesale copying of American machine tools by an English firm—John Holroyd & Co., Limited, of Manchester. It appeared to us that an interesting question in ethics was involved, and that it would be not only of interest, but of some value as well, to find out what English opinion on such a matter really was. Since our publication of the article referred to, the matter has been touched upon by several English journals, and in a manner not complimentary to those who did the copying. This is, apparently, what has led John Holroyd & Co., Limited, to procure the publication of a defense of their course in *Industries*, a well-known English trade journal.

This defense is probably as good as any that could be made, still we do not believe it is quite satisfactory to the one who wrote it. We at least hope it is not. For example:

There are no patents existing in this country for any of the tools in question, and we contend that it is as unreasonable to endeavor to establish a monopoly in a drilling machine, a lathe, or milling machine, as it would be in the case of the locomotive engine or the sewing machine. Had we obtained the designs of the machines in any surreptitious or underhand manner, our conduct would no doubt deserve reprobation; but we consider that if we purchase and pay for a machine unprotected by patents we have a perfect right (more especially with the example of other nations before us) to reproduce it, or such parts of it as we may approve.

Just what "the example of other nations" has to do with "a perfect right" is not clear, except it is upon the assumption that a good many wrongs make one right—a proposition that would make trouble with everything in the shape of moral philosophy. As there is no question of legal right, it must be assumed that "perfect right" refers to a possible moral contingency, and while there may be, in a moral point of view, no difference between reproducing a machine, "or such parts of it as we may approve," and building up a business on the basis of the inventions of other manufacturers, and their catalogues, still in the latter case the magnitude of the scheme is reasonably sure to insure attention being called to it.

Reference is made in the communication in *Industries* to English authors. The writer presumably had in view the reproduction of their works in this country by American publishers, without offer of remuneration. This is an undoubted wrong, and one that the more reputable publishers in this country are anxious to see rectified. But we are not aware that it is the practice here to reproduce such works without credit to the author, and in many cases he receives something in the way of compensation. The allusion to English authors is hardly a happy one.

It is insisted upon in this communication that "improvements" have been made upon the American machines; but the ethics of selling such "improved" machines by virtue of cuts and descriptions identical with those in the catalogues of American manufacturers is nowhere made clear.

The conclusion of the communication in question is as follows:

We do not wish it to be understood that we disparage American tools, which are in many ways admirable, and well adapted to the purpose for which they were designed. On the contrary, the fact of our having adopted transatlantic ideas so extensively, proves how highly we think of them. In one respect, however, we have not imitated the American makers, viz., in price (our prices being at least 40 per cent. below theirs), and in this fact we believe is to be found the principal cause of the strong display of feeling which has been evoked. In conclusion, notwithstanding the disparity in price, we believe that the quality of our work will be found to compare not unfavorably with that of any of the American makers.

We should hardly think, under the circumstances, they *would* "disparage" American tools. So far as their opinion is of value they have—very wisely in a business point of view—given American tools what we believe is called a first-class "reading notice." And we do not think the notice of lower prices that they contrive to get in for themselves is likely to do their American competitors any harm, either here or in England. Machine tools are not sold at so much per name in either country. In that respect they are a good deal like watches, or pocket knives, and a good many other things.

If one were disposed to be critical he might reply that the English firm, having been to no expense in inventing these tools, and in experimenting in the drawing-room and shops in the way of perfecting them, would have some advantage in the way of price. But then a good reply to that would be that the firm that had had this experience must have gained knowledge worth several times its cost in the way of enabling it to build a better machine than could be built without it. On the whole, we have no doubt that if John Holroyd & Co., Limited, build these tools of a quality equal to those built by their American competitors, the building of them will cost them every cent as much.

Questions and Answers

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(211) W. D. R., Pueblo, Colo., writes: I find in a pump catechism the statement that a centrifugal pump will not force water at all, while a friend says he has seen water forced to a height of 32 feet. Which is right? *A.*—Water can be forced to a greater height than 32 feet with a centrifugal pump, hence we have no reason to doubt your friend's statement.

(212) C. J., Reading, Pa., writes: We have an argument as to the weight of a blast furnace bell; it is 6 feet 9 inches in diameter, and 4 feet 4 inches in height, thickness, 3 inches. Will you kindly state its weight? *A.*—We will, provided you will send us a sketch of the bell, with all its dimensions. The data here given is not sufficient for us to compute the weight of the bell.

(213) J. R., Grand Rapids, Mich., writes: I want to build a boiler for an engine 2½x3 inches. Will a boiler 2 feet high, 1 foot in diameter, with fire-box 8 inches diameter, 10 inches high, and seven flues, 2 inches in diameter, be large enough to make steam for supplying the engine at a speed of 300 revolutions per minute? *A.*—You do not state the steam pressure. Assuming that the steam pressure in the boiler is to be 60 pounds, then the boiler will be too small. We should prefer a boiler with a furnace 11½ inches diameter, and the flues and height of furnace so arranged as to obtain a total heating surface of 22 square feet.

(214) H. N., Bernardston, Mass., has sent us a cross-section of a rotary valve for an engine with cylinder 3½ inches diameter and 4½ inches stroke, and asks: Can this engine with this valve give good results when running at 300 revolutions per minute? and can there be anything done to improve the working of the engine? *A.*—We cannot advise you unless we have a drawing of the valve and valve gear.

(215) B. R. M., Norristown, Pa., asks: What are the general proportions of manholes used by boiler makers? For instance, if the hole is to be 12 inches long, what will be its width? *A.*—There are no fixed proportions. Manholes are sometimes made circular, but generally they are made oval; the largest manholes as generally made are 16x12 inches; another size often adopted is 15x11 inches; and the smallest, through which a boy can pass, is 14x10 inches.

(216) P. J., New York, asks: Will you kindly let me know if there are any schools in which I could learn planing and turning metals? I am well experienced in vise work, but cannot leave my present place and seek employment in a machine shop. *A.*—We do not know of any schools where special lessons in turning and planing metals are given. It seems to us that, in the circumstances in which you are placed, the best way will be to seek machine shops in which overtime is worked, and apply to the proprietor for instructions in the evenings.

(217) N. H., Fargo, Dakota, writes: As I have heard different opinions expressed as to whether an injector will throw water in a boiler when the water level is below the check valve, I wish you would throw some light on the subject. *A.*—An injector will throw water into the boiler above the water line, but this is a very bad thing to do. The feed-water should never enter a boiler above the water line, and therefore the check valves are generally placed considerably below it. If for any reason the check valve has to be placed above, the feed-water should be led below the water line by means of a pipe attached inside of boiler.

(218) C. A. L., Depere, Wis., asks: How much water per minute will flow through six pipes, each 1 inch inside diameter, length of pipe 30 feet, top of water level to lower end of pipe 20 feet? *A.*—Each pipe will discharge about 26 gallons per minute. The total amount discharged per minute through the six pipes will be $26 \times 6 = 156$ gallons. Any bends in the pipes will reduce this quantity; the reduction will depend on the character of the bends. 2. How much water per minute will a pump force through four 1-inch pipes? Pressure on the water end of pump 100 pounds per square inch; length of and turns in pipes reduces the pressure to 60 pounds one foot from end of pipe, where it discharges. *A.*—About 229 gallons per minute will be forced through each pipe, making $229 \times 4 = 916$ gallons per minute for the four pipes.

(219) W. T., Cloverdale, Cal., writes: I see in an English journal that locomotives of the three cylinder compound type are being built at Crewe, in view of a renewal of the race to Scotland in May. They are about 20 tons heavier than those at present in use. Please state the usual weight of a United States locomotive, the weight of an English locomotive, and the weight of the compound locomotive lately imported by the Pennsylvania R. R. *A.*—You should have stated the type of locomotive and diameter of cylinders, as the weights of the different types and sizes vary. The average weight of an American passenger locomotive, 4-wheeled connected, with cylinders 17 inches diameter, is about 78,000 pounds. In our issue of August 8th, 1885, we have given tables of the different types and sizes of American locomotives. These tables are too long to republish in the Q. and A. columns. The weight of the compound locomotive lately imported by the P. R. R. is about 99,000 pounds.

(220) J. B. M., St. Louis, Mo., asks: Is there any definite rule for placing the gauge cocks on upright boilers? Does it make any material difference in regard to their position, when the tube sheet is submerged? *A.*—There is no definite rule; the general custom is to use three gauge cocks for small boilers, placed about 2½ inches from center to center, measured in a vertical direction. In vertical boilers the height of the water carried above the crown-sheet is scarcely ever more than 12 inches; hence the lowest gauge cock is generally placed from 10 to 15 inches above the crown sheet, according to the height of the water to be carried. In some vertical boilers the whole length of the tubes are covered with water; in such cases the lowest gauge cock is placed on, or one inch above the lowest desired water line. For further details see answer to Question 384 in our issue of August 18, 1888. 2. What is the advantage, if any, of a tubular boiler over the ordinary flue boiler? *A.*—The former will require less room; otherwise the difference is questionable. 3. What difference, if any, is there between an injector and an inspirator? *A.*—The difference lies in the construction and general design. As regards their action, both have their advocates.

(221) Mac, San Francisco, Cal., writes: I would like to know what power would be required to stop a floating body in a given distance, and going at a certain speed. For instance, take the "Umbria," of the Cunard Line, a vessel capable of a speed of 20 miles an hour, and taking into consideration her dimensions, what force would be required to bring her to a dead stop in a distance of 100 yards, without the use of her propeller in any manner? *A.*—Here we must first find the amount of energy stored up in the body at any given velocity. Thus, let v represent the velocity in feet per second at which a body is moving, and w the weight in pounds of the body; then the stored-up energy will be equal to

$$\frac{w\ v^2}{64.4};$$

the answer will be in foot-pounds. Now the body cannot be brought to rest until the whole stored-up energy be taken away. But this energy cannot be taken away unless a certain amount of work is done, and this work is equal to the product of the force into the distance through which it acts. Let f be the force in pounds, and s the distance through which it acts, then we have $f\ s = \frac{w\ v^2}{64.4}$. Hence we have the following rule: Multiply the weight in pounds of the given body by the square of its velocity in seconds, and divide the product by 64.4; the quotient will be stored-up energy in foot-pounds. Divide this energy by the distance in which the body has to be brought to rest; the quotient will be the force in pounds required to bring the body to rest.

(222) S. F., San Francisco, Cal., writes: Suppose a moulding machine head, 10 inches long, provided with two bearings, one at each end of the head, which is provided with two cutters, each 2 inches long, and in every respect alike. These cutters are on opposite sides of the head, but one of them is close to one bearing while the other is close to the other bearing, so that they are at opposite ends of the head as well as upon opposite sides. Why will the head not be in balance under such conditions? *A.*—It will be in standing balance, of course, but not in running balance. It is plain that each end of the head under such conditions, considered by itself, and without reference to the other end, is out of balance, both standing and running. If the head should be cut in two through the middle, then, of course, it is clear that each end would vibrate independently of the other; but, so long as the cutters retained their relative positions, one end would be vibrating in one direction while the other would be vibrating in the opposite direction. They do much the same thing though joined together, and the best way to balance the head perfectly is to put a weight opposite each cutter equal to the weight of the cutter, provided, of course, that it be placed at the same distance from the center of the shaft. If not convenient to do it in that way, then place one of the cutters in position, and balance the head by placing the journals upon level straight-edges, adding the weight necessary to do this to the end of the head upon which the cutter is fastened. When it is in perfect standing balance, put on the other cutter and balance the head again, adding the necessary weight to the other end. The head will then be in both standing and running balance. The principle will appear plain to you if you imagine a shaft 100 feet long, having at each extremity a pulley badly out of balance. These pulleys could be turned upon the shaft so they would balance each other standing; but as soon as the shaft revolved rapidly, each end of the shaft would shake independently of the other end, and the necessity for balancing each pulley within itself, and without reference to the other pulley, would become apparent.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

20″ Upright Drills. J. E Snyder, Worcester, Mass.
23″ Upright Drills. J. E. Snyder, Worcester, Mass.
25″ Upright Drills. J. E. Snyder, Worcester, Mass.
28″ Upright Drills. J. E. Snyder, Worcester, Mass.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Special tool work. R. M. Clough, Meriden, Conn.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Machine Screw Taps of all sizes and threads, manufactured by S. W. Card & Co., Mansfield, Mass.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Castings for small and medium sized vertical engines. Humphrey's Foundry, Bellefontaine, O.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Best silk wiping towels for machinery in the market. S. A. Smith, 23 S. Canal st., Chicago, Ill.

Iron Planers from 16″ to 36″ wide by any length. H. C. Pease & Co., Worcester, Mass.

Schmidt & Co., 23 Centre st., N. Y. Consulting engineers and draftsmen. Power measured.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illustrated. Frasse & Co., 92 Park Row, New York.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

The hook on steam engines is being supplanted by the Dill disconnecting device, made by the T. C. Dill Machine Company, 726 Girard ave., Phila., Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See May 9, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

The best Emery Wheel made is the "Norwich." For particulars send to Montgomery & Co., 105 Fulton st., New York.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages illustrated, 12mo., cloth, $2.00. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.

Patent or shop rights for sale, for perforating iron or steel plates for steam boilers, bridge work, iron or steel ship work, marine boiler heads, equal to drilled work and fifteen times quicker. Samples can be seen and circulars obtained from R. E. Dietz, 60 Laight St., New York.

The International Boiler Co., Limited (Allan Stirling, M. E., president,) manufacture the safest, most economical, compact and durable water tube boilers. All wrought metal. Large mud drum. Perfect circulation. By unscrewing only three bolts, access is gained to every part of the boiler. Dry steam and great economy of fuel guaranteed. Office, 74 Cortlandt street, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including April 25, 1889 issue, 75 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 89 articles have thus far appeared up to and including the April 18, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

The town of Tarboro, N. C., will put in an electric light plant.

The Georgia Hosiery Co. will build a knitting mill at Macon, Ga.

The High Point (N. C.) Machine Works will increase their plant.

The North Carolina Wagon Co. is building a factory at Raleigh, N. C.

Work has begun on the construction of the woolen mill at Dexter, Me.

Jones & Brantwell have purchased the Alabama Iron Works at Columbia, Ala.

John Schubert and other parties will build a furniture factory at Pensacola, Fla.

The Anniston City Land Co. is interested in building an iron foundry at Anniston, Ala.

The Decatur (Ala.) Car Wheel Co. will double its plant, and will do a general foundry business.

The Fort Payne Coal and Iron Co. is interested in building a large cotton mill at Fort Payne, Ala.

A company has been formed by W. P. Scates, to manufacture his turbine water wheel at Knoxville, Tenn.

The Citizens' Gas Light Co. will increase its capital stock, and improve the gas works and electric light plant.

The Sherman (Texas) Iron Works, which have been idle for some time, will be enlarged and put in operation.

The Triumph Refrigerating Machine Co. has been chartered, to build refrigerating and ice machinery, at San Antonio, Texas.

The Fort Worth (Texas) Manufacturing Co. has been chartered, to manufacture woolen and cotton goods. Capital stock, $100,000.

The Thomson-Houston Electric Company, of Lynn, Mass., is erecting another factory building, 90x190 feet, three stories high.

Carnegie, Phipps & Co., are making 24-inch beams at their Homestead (Pa.) plant for Cramp & Sons.

At Manchester, N. H., the Stark corporation will build a new mill 500 feet long; the Amoskeag corporation is also building a new mill.

The Perry Stove Works at South Pittsburgh Tenn., are about completed, and work will soon be going on as usual in all departments.

The Megunticook Woolen Company, of Camden, Me., which has just been formed with a capital of $300,000, will build a large woolen mill.

The Cheshire Shoe Company, of Pittsfield, Mass., will immediately commence the erection of a three-story factory, 200x75 feet, besides several other buildings.

M. J. Whittall is to erect a new carpet mill at South Worcester, Mass. It will be 275x60 feet, two stories high. The new mill will give employment to 172 extra hands.

The Overman Wheel Company, of Chicopee Falls, Mass., is to enlarge its works by pulling down part of the old shop and building a brick addition four stories high and 160 feet in length.

It is said that the consolidation of North Chicago Rolling Mills, and the Union and Joliet Steel Companies is intended not only to solidify the interests of these companies in their regular business, but also to bring about the manufacture of tin plate.

The South Tredegar Nail Works, at Chattanooga, Tenn., have just invested an additional $60,000 in the nail department, and have rebuilt the works in a greatly improved manner. The works will very soon be in operation with a full corps of men.

Edward Miller & Co., manufacturers of the Rochester lamps, are building a large addition to their factory in Meriden, which will double their office and storage capacity. Other additions are being built for a blacksmith shop, copper storage and dipping rooms.

The newly formed P. C. Holmes Company, Gardiner, Me., propose making extensive improvements in their works. These will include a brick foundry 60x100 feet, and a new machine shop. The company manufacture water-wheels, gearing, and do all kinds of mill work.

The Globe Iron and Brass Works, foundry department, Sheffield, Ala., is now in full operation. They have turned out their first lot of castings, and are now having patterns made to cast a piston which will weigh 3,500 pounds, and a bell to weigh about 5,500 pounds, both for the "Cole" furnaces.

The Iron and Land Improvement Company has been organized at Clifton Forge, Va. Mr. Throppe, of Philadelphia, is president; Hon. J. Yost, manager and vice-president, and John D. Weeks, of Pittsburgh, one of the directors. The capital stock is $100,000, all taken. An industrial town will be built.

Black & Clawson, Hamilton, Ohio, are building paper mill machinery for outfit for one mill in Australia, one in Mexico, and one in Canada, and also have an order for the largest they have ever yet built, which is to go into a mill in Wabash, Ind., which is being built and equipped by the Diamond Match Company, of Akron, Ohio.

The large addition now being built by the Hartford (Conn.) Machine Screw Company is to be stocked with new machinery, and will give employment to 100 additional hands. It will also relieve the present crowded factory and give additional room to the American Writing Machine Company, which occupies part of the building.

There is water-works agitation at Batesville, Ark.; Mammoth Spring, Ark.; Russellville, Ark.; Cartersville, Ga.; Columbus, Ga.; Dalton, Ga.; Gainesville, Ga.; Covington, Ky.; Mount Sterling, Ky.; Nashville, Tenn.; Jefferson, Texas; McGregor, Texas; Hickory, N. C.; Greenville, Ala.; Luling, Texas; Marietta, Ohio; Newbern, Tenn.; Ainsworth, Neb.

The new charcoal blast furnace of the Montalto Iron Company, at Montalto, Pa., was totally destroyed by fire last Tuesday. The fire caught from the stack. The furnace was entirely new, and had been put in operation only two weeks ago. It was fitted up with the latest improved engines, hoisting apparatus, blast and machinery, and was the finest charcoal plant in the country.

It is claimed that the Falls City Malleable Iron and Steel Works, of Louisville, Ky., can make, at a cost of 25 cents, a mortising chisel used by woodworkers which now retails for $4.50. The company have received a proposition from a Canadian syndicate to establish works in Canada, which will secure the patent under the laws of that country, and result in the establishment of a large factory there.

John S. Holden, of Palmer, Mass., has purchased the Bennington (Vt.) Woolen Mills, and will start them immediately. This plant cost nearly $1,000,000, and is the finest in Vermont. It is understood that the purchase price was 8 per cent. of the original cost. These extensive mills have been idle over three years, the former owners having gone through bankruptcy. Their shut-down caused a decrease of 1,300 in the town's population.

The Cincinnati Corrugating Company are about to establish a sheet mill at Piqua, as an adjunct of their corrugating works in Cincinnati. The works at Piqua will occupy several acres of ground, and will enable the Corrugating Company to not only make their own sheets, but will also afford room and facilities for the enlargement of several specialties, such as galvanizing iron awnings, shutters, etc., which this company has already developed into considerable importance. The works at Piqua will be operated with natural gas.

Machinists' Supplies and Iron.

NEW YORK, May 11, 1889.

Iron—American Pig.—The reduction of $1.00 per ton, made by the Thomas Iron Co., though much talked about, has been discounted by actual sales for some time past, and the condition of the market is much the same as before, prices being irregular, and to some extent nominal. We quote standard Northern brands, No. 1 X Foundry, $17; No. 2, $15.75 to $16; Grey Forge, $14.50 to $15.50.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Situation as foundry foreman; large experience. Good reference. Box 97, AM. MACHINIST.

Wanted—A first-class lathe hand with $1,000. A good salary will be paid to a first-class man. Address Box 90, AMERICAN MACHINIST.

Wanted—By a man of experience, a position as supt. or chief draftsman in locomotive or stationary engine shop. Address M. E., AM. MACHINIST.

Mechanical draftsman (22), graduated at a German technical college, wants position. Salary, $12.00 weekly. Address Box 98, AMERICAN MACHINIST.

Mech. engineer and draftsman, inventive and of progressive ideas, with good all around experience, desires engagement. Address Box 99, AM. MACH.

Wanted—A man to temper dies, taps and reamers. Must be competent and understand the best methods of tempering steel. Address Box 94, AMERICAN MACHINIST.

Wanted—Salesman, to sell a boiler feed-water purifier and heater. Reference required as to ability and experience as salesman. Address H. M. C., AMERICAN MACHINIST.

Wanted—A first-class machinist with $5,000 to $10,000 cash in an old and well-established manufacturing business. Address P. O. Box 104, Baltimore, Md., giving reference, age and experience.

Wanted—By a machinist experienced as draftsman and designer, and successful in handling men, a position of responsibility, preferably as supt. or to travel. Address C. S., AMERICAN MACHINIST.

Wanted—A situation as foreman by an experienced pattern maker and draftsman well up in the work. Eng. and general machinery; Western location preferred. "Machinery, B.," AM. MACHINIST.

Wanted—Situation by a practical machinist, accustomed to engine work and jobbing; or would take charge of a shop, or erecting work outside. Address Marine, care AMERICAN MACHINIST.

Wanted—Foreman for steam pump works. Must have experience in handling men, and in the best methods of getting out "Duplex" pumps; state age, experience, and salary expected. Address "Ohio," AMERICAN MACHINIST.

Wanted—Foreman for machine shop in agricultural works; experienced in building portable and traction engines and general work, and capable of handling men on piece-work; state experience, age, and compensation expected. Address Box C, Schenectady, N. Y.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, O.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Steel Name Stamps, Copper Burning Brands, etc. W. G. Sackmann, 1099 First av., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Room and power to rent to suit any capacity, large or small. Inquire of Hartford, Conn., Board of Trade.

For sale—Second-hand gear cutter (E. & R. J. Gould, makers.) As good as new and cheap. Bettermann & Vaughen, Limited, Johnstown, Pa.

Wanted—A 2nd-hand pulley 9 or 10 feet diameter, 20 to 24 inch face, bored 7 inch, weight, 40 to 50 hundred. Jerome Moltz, Williamsport, Pa.

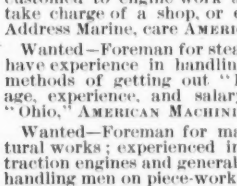
Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted—100 or more machinists or amateurs to send for model engine castings; complete in sets; send for circular. Lowell Model Co., 170 Merrimack Street, Lowell, Mass.

Wanted—12-inch swing screw-cutting lathe. Will exchange Rudge convertible Sociable, cost $235 (makes excellent single), or Rover type Safety; or would pay cash if low. 2,000 13th Street, N. W., Washington, D. C.

NOISELESS.



The Almond Coupling

A NEW quarter turn motion to replace quarter turn belts and bevel gears.

T. R. ALMOND, MFR.,
93 and 95 Washington Street,
BROOKLYN, N. Y.

Established 1852.

BRADLEY'S HELVE HAMMER.

BRADLEY'S POWER HAMMERS
The BEST in the WORLD
RUN BY BELT.

BRADLEY'S UPRIGHT HAMMER.

Over 1500 in USE

BRADLEY'S UPRIGHT HAMMER.

BRADLEY'S HEATING FORGES

BRADLEY'S HARD COAL HEATING FORGE.

Indispensable in all shops to keep BRADLEY'S CUSHIONED HAMMERS and men fully employed and reduce the cost of production.

BRADLEY'S SOFT COAL FORGE.

BRADLEY & CO. SYRACUSE, N.Y.
63 Murray st. NEW YORK; 98 Sudbury st. BOSTON, MASS.

SOLID EMERY OIL STONES AND Triple Coated KNIFE SHARPENER
WHOLESALE ONLY BY THE TANITE CO., STROUDSBURG PA.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.
☞ Our New and Revised Catalogue of Practical and Scientific Books, 80 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

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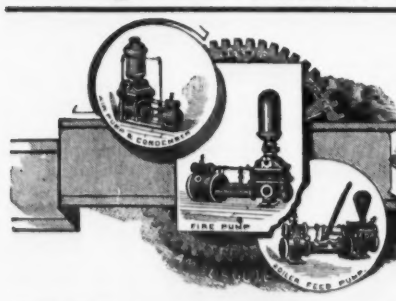

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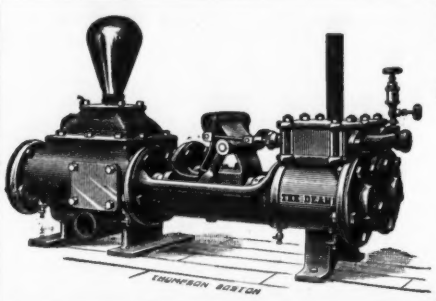

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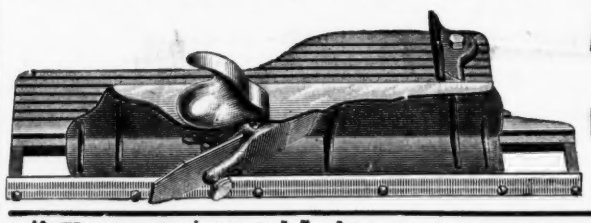

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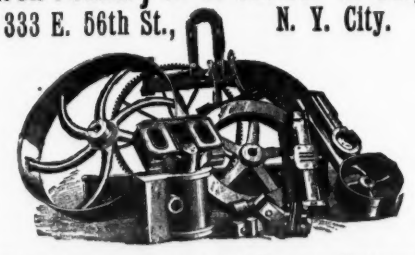

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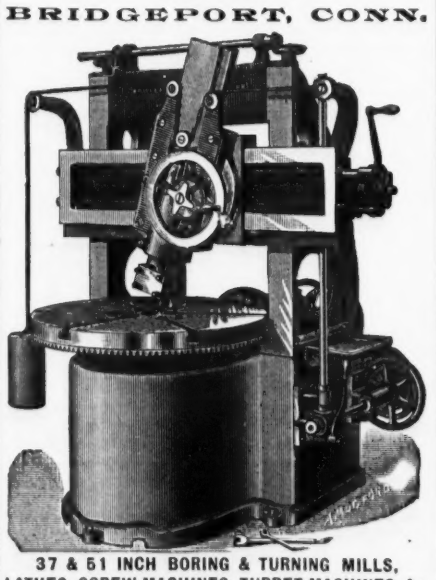

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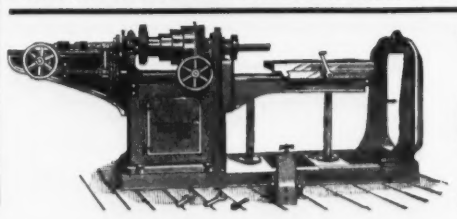

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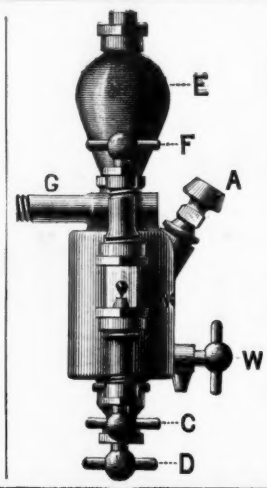

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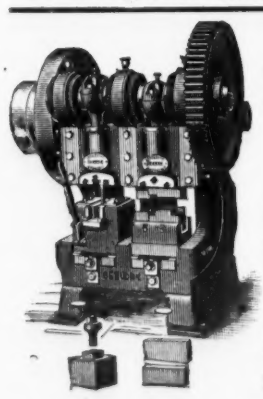

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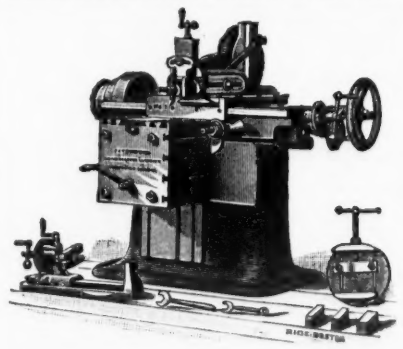

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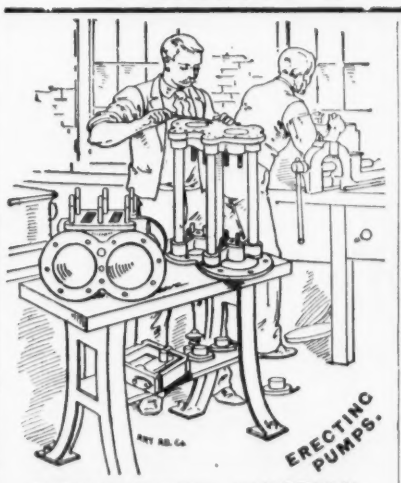

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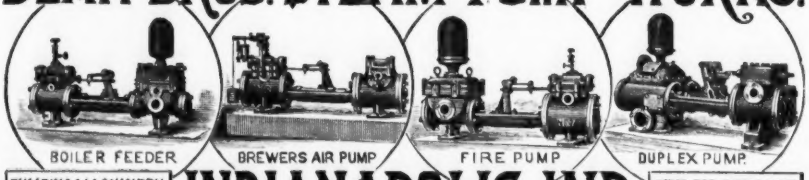

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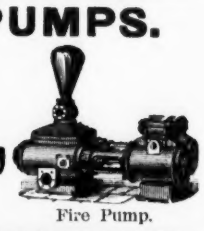

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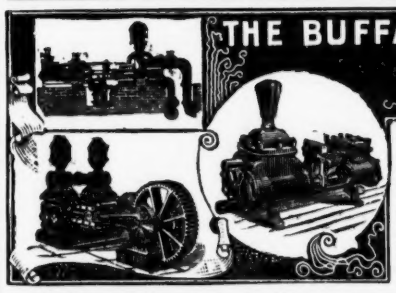

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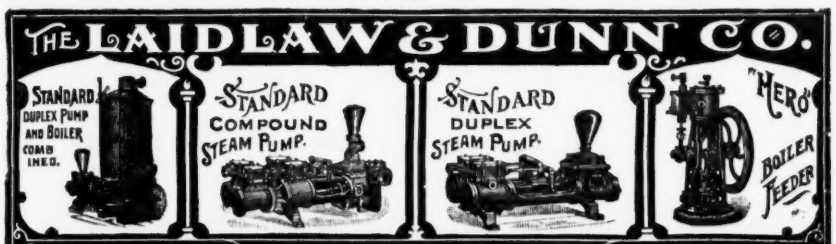

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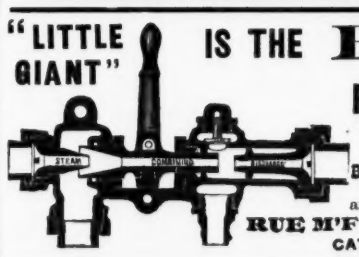

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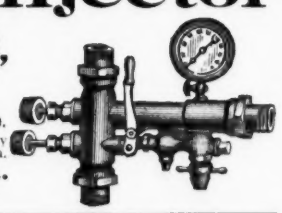

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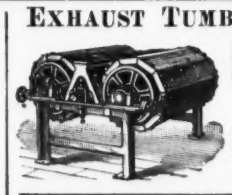

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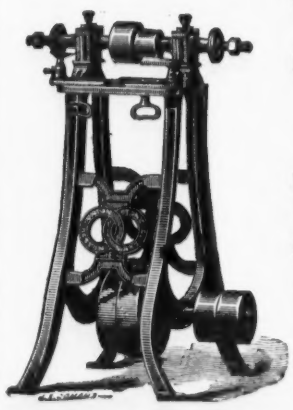

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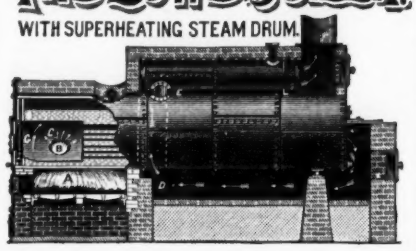

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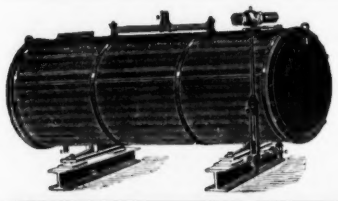

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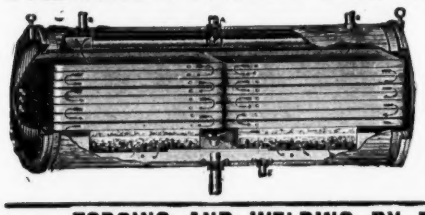

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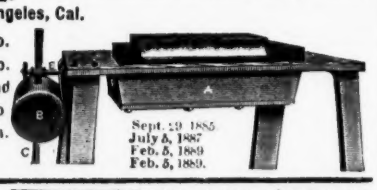

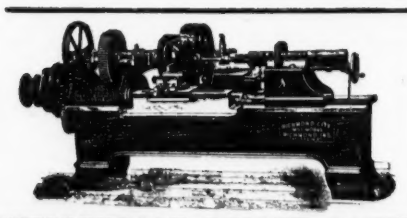

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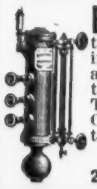

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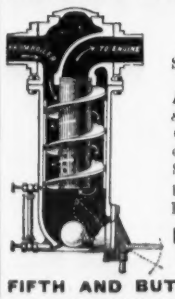

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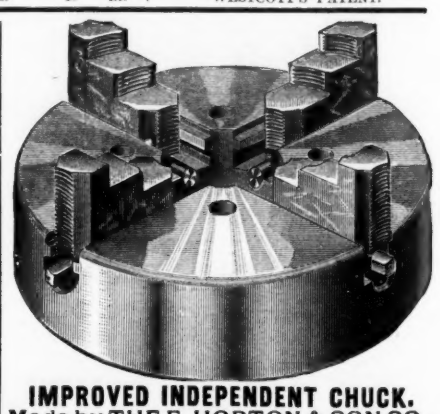

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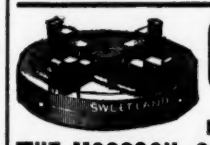

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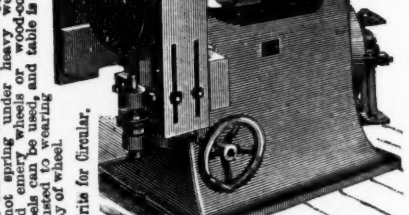
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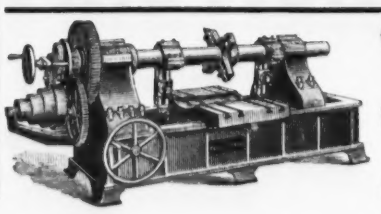

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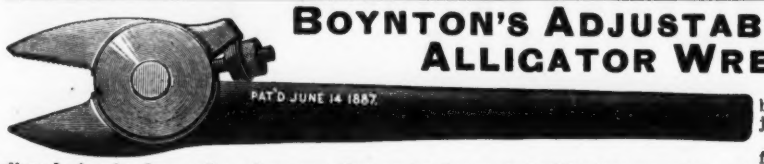

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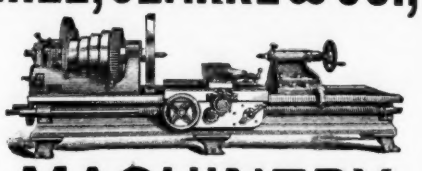

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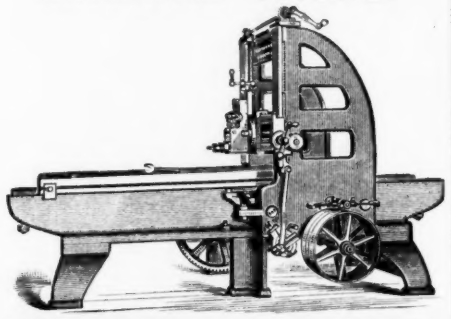

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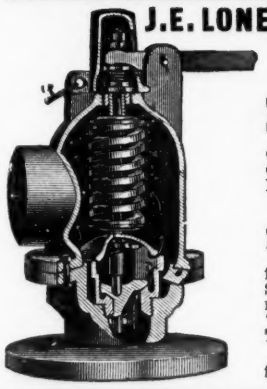

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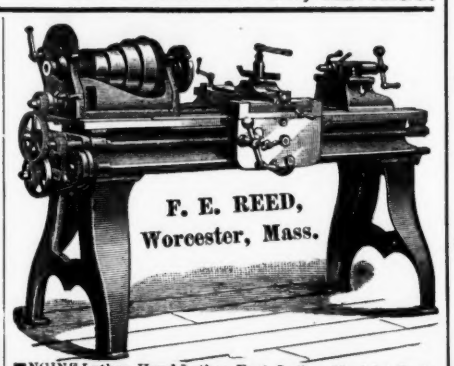

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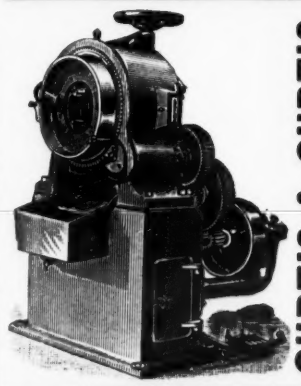

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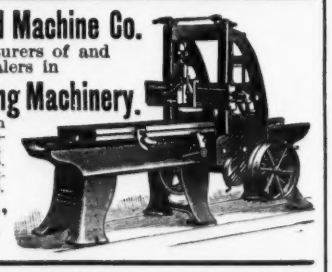

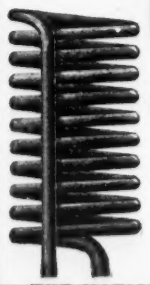

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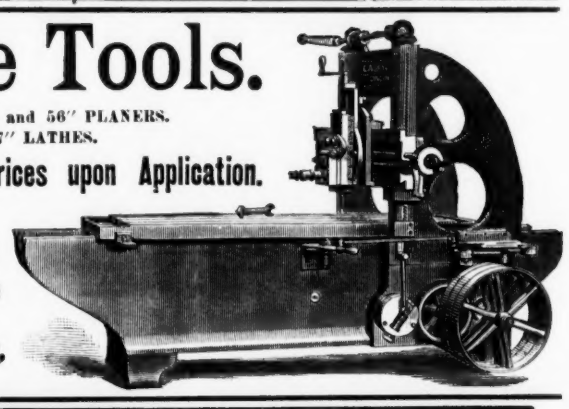

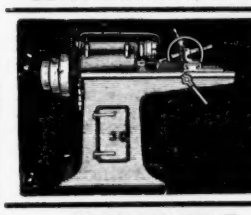

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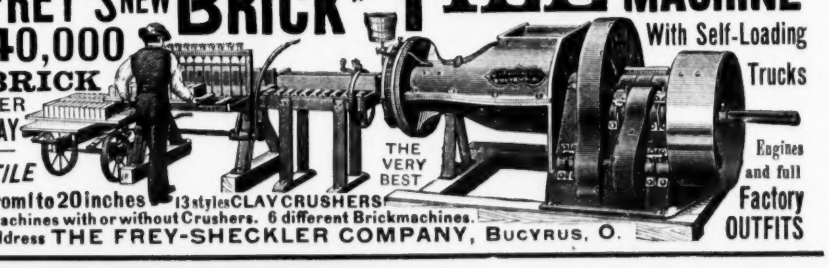

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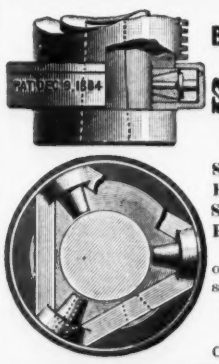

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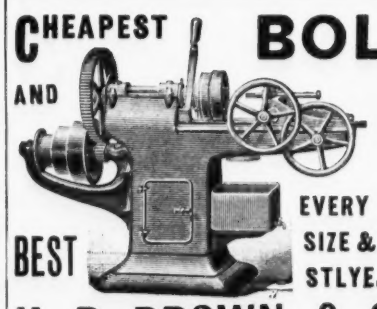

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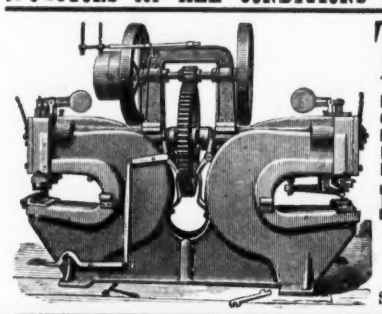

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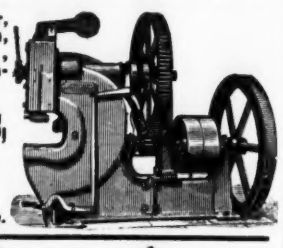

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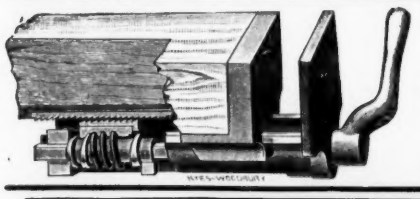

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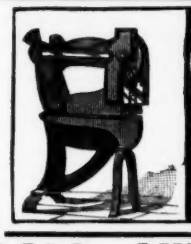

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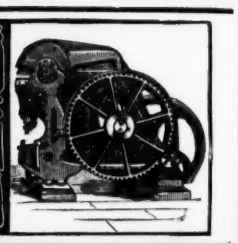

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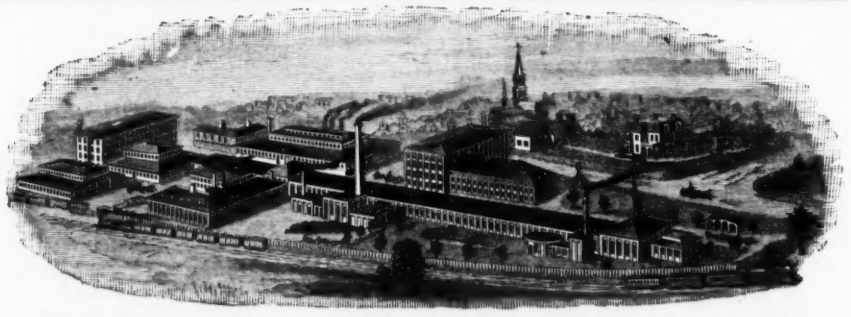

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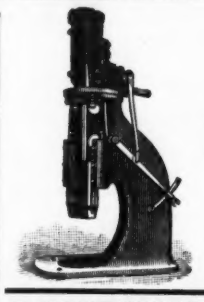

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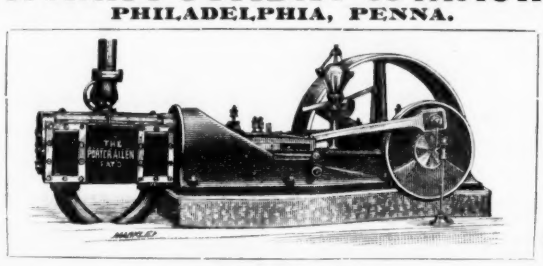

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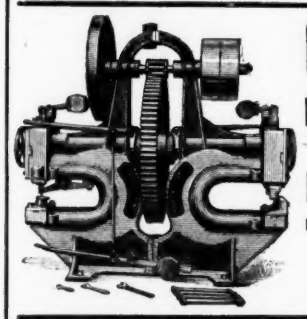

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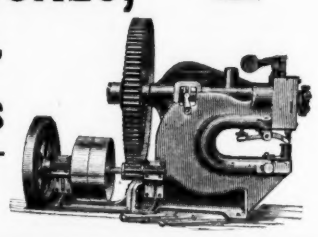

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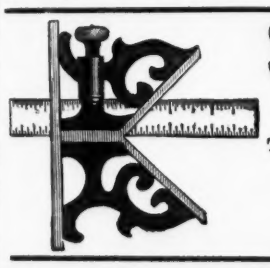

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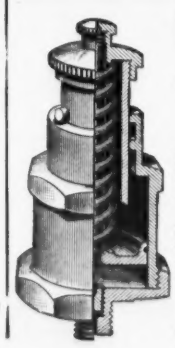

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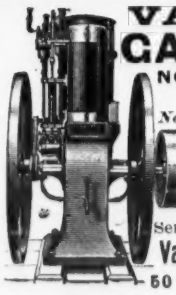

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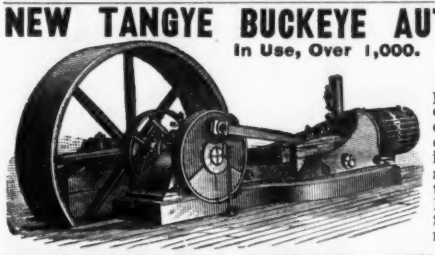

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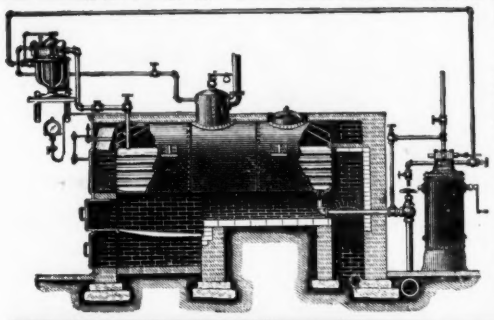

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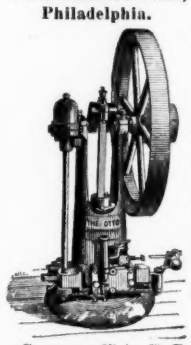

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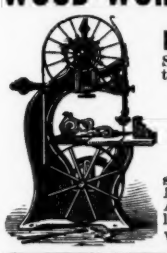

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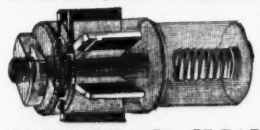

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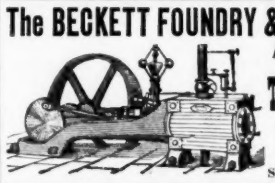

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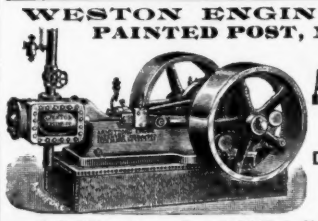

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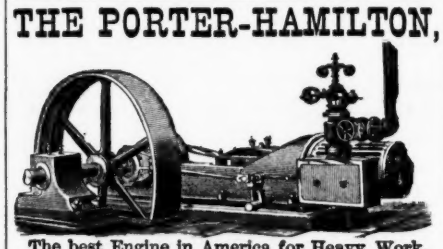

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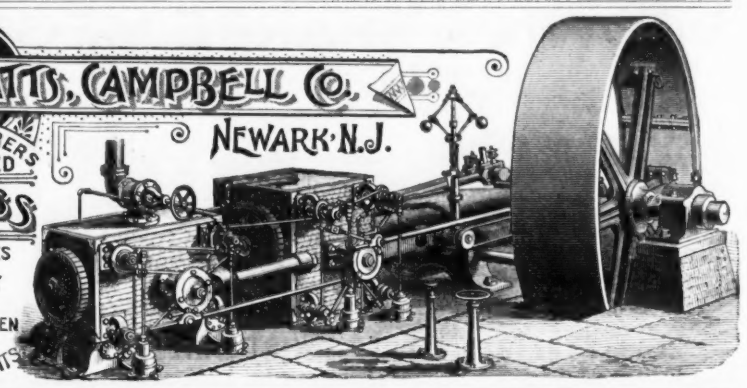

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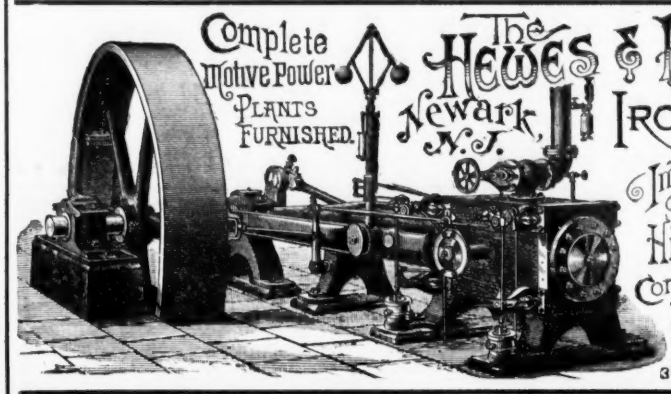

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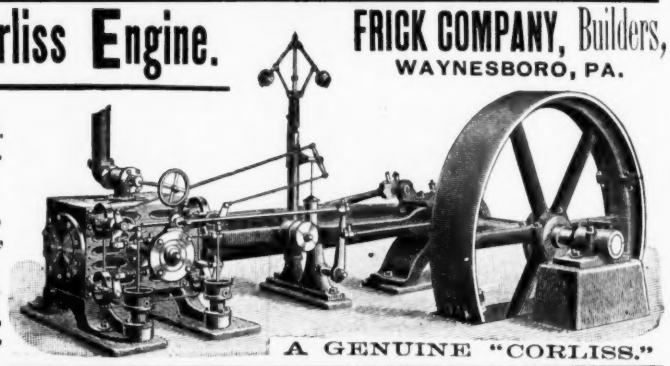

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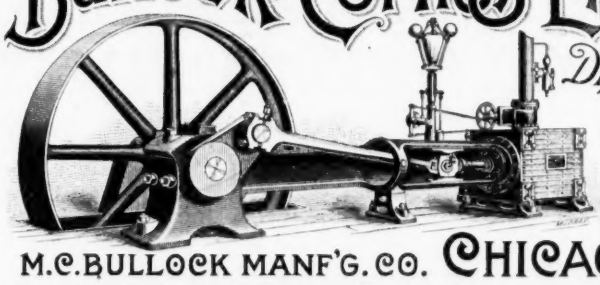

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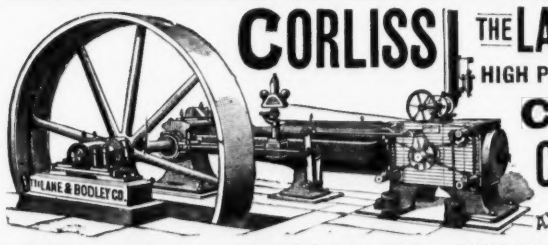

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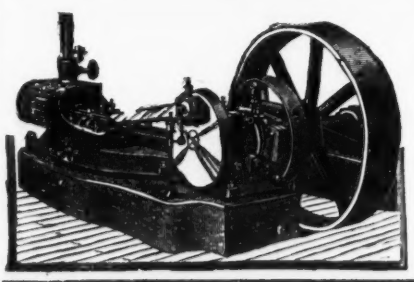

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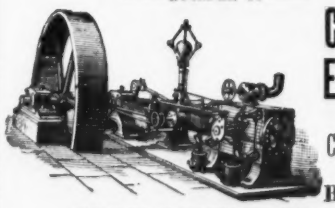

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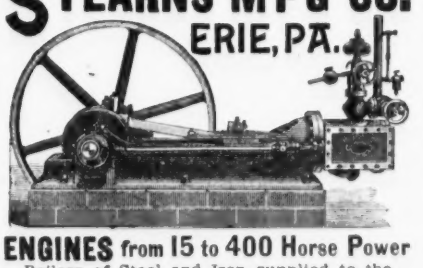

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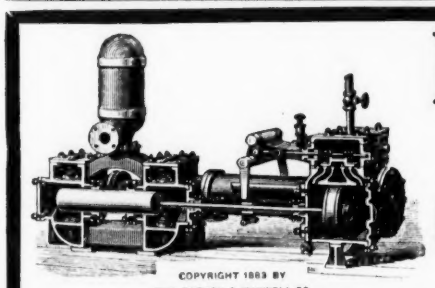

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BRANCH HOUSES:

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CRANES

THE YALE & TOWNE MFG CO.,
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NEW YORK CHICAGO PHILA. BOSTON

JENKINS BROS. PUMP VALVES.

We make a specialty of Hard Rubber Pump Valves for Hot Water, Oils and Acids, also for very high pressures.

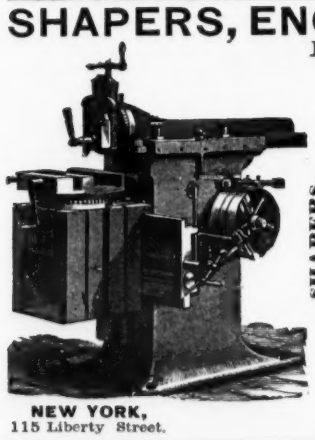
Accept no Pump Valves as JENKINS or JENKINS BROS., unless stamped like cut.

JENKINS BROS.,
71 John St., New York.
54 Dearborn St., Chicago.
105 Milk St., Boston.
21 No. Fifth St., Phila.

SHAPERS, ENGINE LATHES & DRILLS.

LODGE, DAVIS & CO.,

CINCINNATI, OHIO.



SHAPERS, 15" and 20" Crank. 20", 26", 32" Geared.
ENGINE LATHES, 17", 19", 21", 24", 27", and 38".

20 inch Upright Drills. 25 inch Back Geared, and
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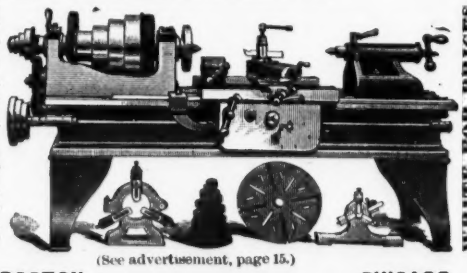
28, 32 and 40 inch Power Feed Drills.



WRITE FOR PRICES, IT WILL PAY YOU.

(See advertisement, page 15.)

NEW YORK, 115 Liberty Street.
BOSTON, 23 & 25 Purchase St.
CHICAGO, Cor. Lake & Canal Sts.

WHAT our customers say about the

EBERHARDTS PATENT DRILL PRESS.

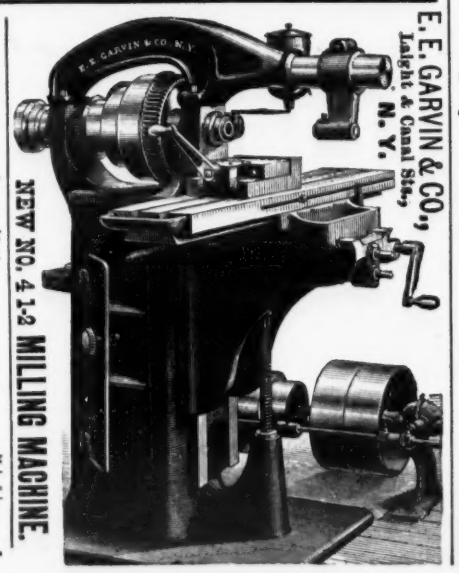
The only one built on **correct principles.**
More **economical** than any we have ever used.
Can do **double** the work. Most convenient.
Best in the market. Much admired.
No trouble or expense for repairs.
Could not ask for anything better.
There may be as good a one made by some one else, but **I have not seen it.**
I feel that **I did wisely** in buying your tool.
We consider it a **model tool** and fills the whole bill.

Below we give the names of a few who are using our PAT. DRILL SHAPERS, etc.

	Machines.
Missouri Pacific Railway Co., St. Louis, Mo.	3
Eames Vacuum Brake Co., Watertown, N. Y.	4
Carnegie, Phipps & Co., Pittsburgh, Pa	2
American Brake Co., St. Louis, Mo.	3
Worthington Pump Works, Brooklyn, N. Y.	2
King Iron Bridge Works, Cleveland, O	9
Filer & Stowell Mfg. Co., Milwaukee, Wis.	3
Hutchinson, Hollingsworth & Co., England	5
Daft Electric Light Co., Marion, N. J.	3
C. H. Hunt & Co., New York City	2
R. Hoe & Co., New York City	10
Cooke Locomotive Works, Paterson, N. J.	4

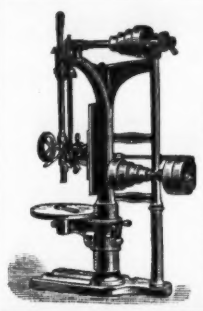
Also, Standard Oil Co., Lima, O.; Morgan Engineering Co., Alliance, O.; Grand Trunk Railway of Canada, Montreal, Can.; Brainard Milling Machine Co., Hyde Park, Mass.; Boston Bridge Works, Boston, Mass.; Pond Machine Tool Co., Plainfield, N. J. Write to

COULD & EBERHARDT,
For Catalogue A. NEWARK, N. J.



E. E. GARVIN & CO., Laight & Canal Sts., N. Y.

NEW NO. 4 1-2 MILLING MACHINE.



THE PRATT & WHITNEY CO.,

Hartford, Conn.,

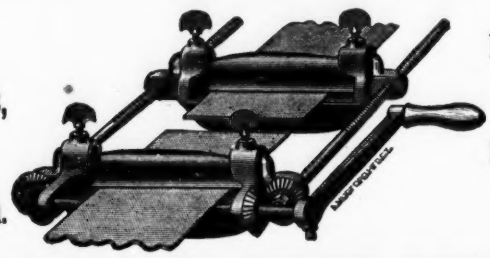
MANUFACTURE

Renshaw's Ratchet Drills, Nos. 1 and 3; **Upright Self-Feeding Hand Drilling Machines** for Blacksmiths; **Upright Drilling Machines,** single and multi-spindle, both those in which the spindles are without feed movement and tables are operated by hand or foot lever, and those in which the tables have provision for adjustment, and spindles are fed by hand lever, or by hand wheel, or automatically; also, **Horizontal Drilling Machines,** single and multi-spindle.

WESTERN BRANCH, 100 West Washington St., Chicago, Ills.

THE BILLINGS & SPENCER CO., Hartford, Conn.

Belt Clamps, IN Eight Sizes, FROM Eight Inch TO Thirty-six Inch.



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DROP-FORGINGS OF EVERY DESCRIPTION.

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FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

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Gear Wheels and Gear Cutting.—I make g to order, or cut teeth on g blanks sent to me. Of all kinds. Of all sizes to six ft. dm. Small orders or large ones. Fine g or cheap g. Small cast g. Ready made brass g by mail at low prices. Bevel g with perfect planed teeth. Hand Book on g, $1. Facilities complete. Terms reasonable. Send for cat. GEO. B. GRANT, 66 Beverly St., Boston, Mass.

Key-Seating Machines and 20 in. Drills

A SPECIALTY.

SEND FOR LIST OF

New and Second-Hand

Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.

W. P. DAVIS,
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Works at North Bloomfield.

REMOVAL.

THE POND MACHINE TOOL COMPANY,

Formerly of Worcester, Mass.

The new shops of this company are located at Plainfield, N. J., forty minutes' ride from New York city on the line of the Central Railroad of N. J., and consist of the following:

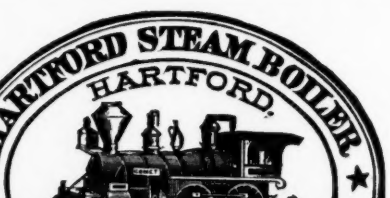
A machine shop 500' long by 100' wide; a foundry 250' long by 90' wide; also commodious buildings for the storage of sand, coal, coke and pig iron; ample and convenient wash rooms for the men; fireproof two story pattern storage; blacksmith shop; engine and boiler houses. These buildings are detached from the machine shop and foundry. There is an elevated railroad for the convenient distribution of raw materials, and a railroad running through the machine shop for shipping. The whole plant is supplied with the incandescent system of electric lighting.

The machine shop and foundry have overhead traveling cranes running through their entire lengths; also light traveling cranes, which serve every tool, and a number of jib cranes in the foundry and scratch rooms. The foundry has capacity for making the heaviest class of castings.

All our tools are expressly designed for the economical manufacture of heavy machinery for railroad and general machine shop equipment, from new patterns of the latest and best designs.

SALESROOM and OFFICE, 111 & 113 Liberty St., N. Y. City.
NEW SHOPS, Plainfield, N. J.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.



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PATENT UNIVERSAL SCREW-CUTTING CENTER DEPTH ANGLE AND **J. WYKE & CO., TWIST DRILL GAUGE.**
Fine Machinists' Tools.—E. Boston, Mass—Send for Circular

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MACHINE TOOLS.

THE G. A. GRAY CO.,

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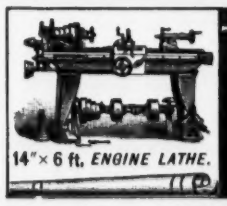
See advertisement, page 13.

STEEL CASTINGS.

PRATT & LETCHWORTH,
PROPRIETORS
BUFFALO STEEL FOUNDRY,
BUFFALO, N. Y.



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IRON & BRASS WORKING MACHINE TOOLS

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